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R. P. Whitfield. J. A. Allen.
Henry Fairfield Osborn. Wm. Beutenmüller.
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EDITOR OF BULLETIN.

J. A. Allen.

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BULLETIN

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AMERICAN MUSEUM OF NATURAL HISTORY.

Volume VII, 1895.

Article I.—FOSSIL MAMMALS OF THE PUERCO BEDS. COLLECTION OF 1892.

By HENRY FAIRFIELD OSBORN and CHARLES EARLE.

The archaic basal Eocene fauna, discovered by Cope in 1880 and extensively described since, still presents problems of the greatest difficulty and interest. What are these peculiar animals? What are their relations to the Mesozoic and Cenozoic mammals? With the double object of completing the historical series and of further elucidating these problems, the Museum sent an expedition into the arid Puerco region early in the spring of 1892.

The expedition was under the able direction of Dr. J. L. Wortman assisted by Mr. O. A. Peterson, and Mr. Thomas Raffierty in the field. The explorations were in the San Juan Basin of northwestern New Mexico. The Museum is indebted to Mr. E. T. Jeffery, President of the Denver and Rio Grande Railroad, for many courtesies.

Dr. Wortman gives the following field notes: "The thickness of the beds is roughly estimated at 800 to 1000 feet, and as far as can be observed they lie conformably upon the Laramie. At no place examined by us can fossils be said to be abundant, but on the contrary most of the exposures are entirely barren. For convenience they are divided into Upper and Lower Beds, but this scarcely gives an adequate idea of the occurrence of the fossils, for the reason that it is only the extreme upper and lower strata that are productive ; the great intermediate part we found to be singularly barren.

"The lower fossil-bearing strata occur in two layers, the lowermost of which lies within 10 or 15 feet of the base of the formation. This is succeeded after an interval of about 30 feet by a second stratum in which fossils are found, and this appeared to be by far the richer of the two. Both of these strata are of red clay, and at no place did we find them more than a few feet in thickness.

"The lower horizon we found exposed in two places, viz.: the head of the Coal Creek or Pina Verta Cañon, and some of the upper tributaries of the Chaco Cañon. It is especially and sharply distinguished by the occurrence of the remains of *Polymastodon*, which appear to be entirely absent from the upper horizon.

"Fossils are much more abundant in the upper strata, and wherever a good exposure was found their occurrence could be more confidently looked for. The genera *Chirox* and *Pantolambda* appear to belong exclusively to the upper beds. Owing to the widely separated localities and the general scarcity of fossils, it is at present impossible to say whether it is one or several layers that produce the fossils from these upper beds. It is my opinion, however, that there are several layers, and that their vertical range is somewhat greater than that of the lower horizon. The principal localities of the upper strata are as follows : head of Cañon Gallego, Cañon Blanco, Cañon Escavada, and head of Cañon Chaco."

The main systematic determination, and the larger part of the description of this collection is the work of my colleague, Mr. Earle. The Creodont section is entirely his, as well as many original suggestions as to the relationships of the Primates and Condylarths. The following are the principal new features :

1. A division of the Eutheria into *Mesoplacentalia* and *Cenoplacentalia*, p. 3.
2. A revision of the Classification, Geological distribution, and Phylogeny of the Puerco mammals, pp. 7–10.

3. Multituberculata: Description of the complete dentition of *Polymastodon*, pp. 11–15.
4. Primates: Description of the skeleton of *Indrodon*, with lemuroid characters. The Chriacidæ added to this group. The new genus *Oxyacodon*, pp. 15–23.
5. Creodonta: *Clænodon* as an ancestor of the Arctocyonidæ. Description of the skeleton of *Dissacus*, an ancestor of the Mesonychidæ, pp. 26–39.
6. Tillodonta: Description of the skull of *Onychodectes*, p. 41.
7. Amblypoda: Relationship of *Periptychus* to this group. Description of a complete skull of *Pantolambda*, p. 43.
8. Condylarthra: Introduction of *Mioclænus* to this group. Systematic revision of the Periptychidæ. *Haploconus* is shown to have probably been arboreal in habit. *Protogonodon* is shown to be related to *Trigonolestes*[1] and the Artiodactyla.

We are indebted to Professor Scott for criticisms of the MSS. upon the Creodonta, and to Professor Cope for the loan of type specimens and for assistance in the determination of species.
—H. F. O.

I.—THE PUERCO MAINLY A MESOZOIC FAUNA.

The Placentals should be considered as having exhibited two great centres of functional radiation, which were successive and largely independent of each other. The first is represented by the groups discovered by Cope in the Puerco, and now proved to have extended back certainly into the Cretaceous, probably into the older Mesozoic—to these may be applied the term *Mesoplacentalia*,[2] or Placentals distinctive of the Mesozoic period. The second is the group, the earlier members of which are found in the Puerco, and which developed and radiated in the succeeding Tertiary; these may be called the *Cenoplacentalia*, or distinctively Tertiary Placentals. The difference between these two groups consists mainly in the lower state of evolution and apparent incapacity for higher development exhibited by the Mesoplacentals in contrast with the capacity for rapid development shown by the Cenoplacentals.

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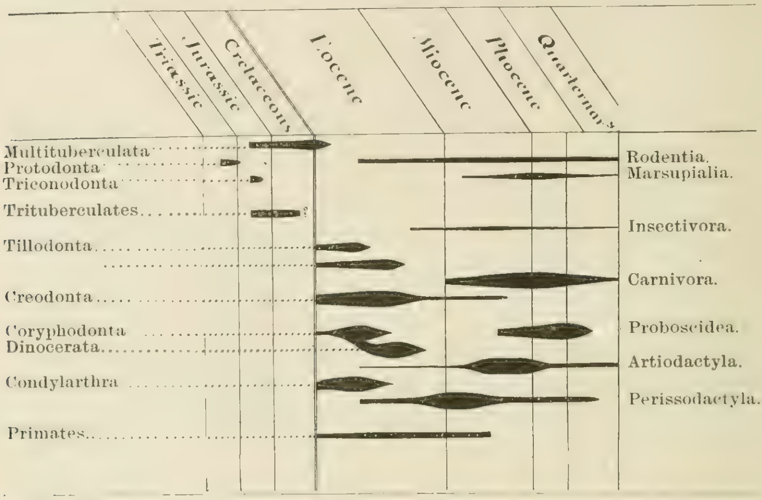
[1] Professor Cope has recently substituted this term for *Pantolestes*, which is preoccupied.

[2] 'A division of the Eutherian Mammals into the Mesoplacentalia and Cenoplacentalia.' Trans. N. Y. Acad. Sc., June 4, 1894.

Succession of the North American Orders of Mammals.



The first of these terms therefore chiefly serves to express the fact that the Mesoplacentals evolved and diverged in North America and undoubtedly in Europe during Mesozoic times in the Jurassic, Cretaceous and Lower Tertiary. Careful studies show that even the Upper Cretaceous mammals had probably already diverged into Ungulate and Unguiculate, Carnivorous and Insectivorous types. This functional divergence reached its climax in the Puerco, which contains several Laramie reptiles, and Cope inclines to consider this epoch as Post-Cretaceous rather than the base of the Eocene. Here the Mesoplacentals display the greatest variety, and are generally characterized by plantigrade feet and tritubercular teeth, for even among the Ungulata the molar teeth are developed upon the triangular plan, whether bunodont, selenodont or lophodont. We may consider the Middle Eocene Dinocerata, Tillodonta and Creodonta as spurs of this great Mesoplacental radiation, a few of the Creodonts only persisting into the Mid-tertiary.

In opposing Cope's view[1] that this fauna, with the exception of the Multituberculata, is largely ancestral, it is important to emphasize the fact that we have not as yet connected any of the Mesoplacentals directly by lineal descent with the Cenoplacentals, excepting *Euprotogonia*, a supposed ancestor of the Perissodactyla ; and *Protogonodon*, a supposed ancestor of the Artiodactyla. A comparison of Tables I and III shows that out of 39 generic and 90 specific types existing in the Puerco, *only 8 generic types are followed by analogous forms in the Wahsatch, and 3 of these became extinct in the Bridger.* But even if more threads of phyletic descent are traced by future research the fact remains that the great group of Mesoplacentals as such became extinct ; that the first attempt of the mammals at wide functional radiation failed, and that from some comparatively unspecialized spurs of this dying group a new functional radiation began which reached its climax in the Cenoplacentals of the Miocene period, and subsequently declined.

TABLE I.—SUCCESSIVE, ANALOGOUS, AND RELATED TYPES.

	LARAMIE.	PUERCO.	WAHSATCH.
Multituberculata	Ptilodus	..×	
		Neoplagiaulax.	
	Meniscoëssus	Polymastodon.	
	Allodon	Chirox.	
Tillodonta		Psittacotherium.	
		Hemiganus.	
		Conoryctes	Esthonyx.
		Onychodectes	"
Creodonta		Clænodon	Anacodon.
	? Batodon tenuis	Dissacus	Pachyæna.
Amblypoda		Pantolambda	Coryphodon.
Condylarthra		Euprotogonia	Hyracotherium.
		Protogonodon	? Trigonolestes.
	(? Didelphops) comptus.	Ectoconus.	
Primates		Indrodon	Anaptomorphus.
		Mixodectes	Microsyops.

---

[1] 'Synopsis of the Vertebrate Fauna of the Puerco Series.' Am. Phil. Soc., Jan. 20, 1888, p. 300.

The Mesoplacentals cannot be defined as a homogeneous group; they are very heterogeneous. No attempt is therefore made to define as Cope has defined the Bunotheria (to include the Creodonta, Mesodonta, Insectivora, Tillodonta and Tæniodonta). What chiefly unites the Mesoplacentals is the possession of a large number of very primitive characters, and the apparent incapacity for progressive evolution. The terms 'inertia' and 'potential,' although new in palæontology, seem to express most perfectly the cardinal difference between the Mesoplacentals and the Cenoplacentals. The inertia is seen in the inability to shake off the primitive mammalian characters and assume the modern mammalian standard. Wherever they came into competition the Cenoplacentals drove out the surviving Mesoplacental spurs just as the Placentals will in time supersede the Marsupials of Australia.

TABLE II.—EUTHERIA: PLACENTALIA.

MESOPLACENTALIA.	CENOPLACENTALIA.
Amblypoda (Dinocerata, Coryphodonta)...........................	Proboscidea.
Condylarthra	Diplarthra: Artiodactyla and Perissodactyla.
Creodonta	Carnivora.
Tillodonta.........................	Rodentia.
Insectivora	. . ×
Lemuroidea.	. . ×
	Anthropoidea.
Incertæ sedis; Edentata, Sirenia, Cetacea.	

Pursuing this hypothetical line of division further, an exception to this elimination, by 'survival of the fittest,' is seen perhaps in two great groups still existing which are universally regarded as extremely primitive; these are the Insectivora and Lemuroidea; both orders are closely paralleled in structure by a number of Puerco types, although we cannot as yet positively assert that the latter are either true Insectivora or Lemuroidea. It may be that we should regard the Insectivora and Lemuroidea as persistent Mesoplacentals.

The division of the Placental orders upon this physiological and developmental basis would, according to this hypothesis, stand as in Table II, in which groups presenting *analogous* adaptations are connected by dotted lines.

II.—SYNOPSIS AND VERTICAL DISTRIBUTION OF THE PUERCO FAUNA.

In the following table the classification is to be regarded as provisional, and subject to extensive modification by future discoveries. The order Insectivora is probably represented, but by what types is uncertain. The Amblypoda may grow at the expense of the Condylarthra by the inclusion of the Lemuroidea is also somewhat doubtful. The Amblypoda may grow at the expense of the Condylarthra by the inclusion of the Periptychidæ.

TABLE III.—SYNOPSIS OF THE PUERCO FAUNA.[1]

	LOWER.	UPPER
1. MULTITUBERCULATA.		
PLAGIAULACIDÆ.		
Plagiaulacinæ.		
Ptilodus mediævus *Cope*		
" trovessartianus *Cope*		
Neoplagiaulax americanus *Cope*	×	
Polymastodontinæ.		
Polymastodon taoënsis *Cope*	×	
" attenuatus *Cope*	×	
" fissidens *Cope*	×	
" foliatus *Cope*	×	
" latimolis *Cope*	×	
" selenodus *O. & E.*		
BOLODONTIDÆ.		
Chirox molestus *Cope*		
" plicatus *Cope*		
2. PRIMATES.		
ANAPTOMORPHIDÆ.		
Indrodon malaris *Cope*		×
MIXODECTIDÆ.		
Mixodectes pungens *Cope*		
" crassiusculus *Cope*		

---

[1] The types not marked with × in the table are those in which no local record has been kept.

TABLE III.—*Continued.*

	LOWER.	UPPER.
CHRIACIDÆ.		
Chriacus pelvidens *Cope*		
" truncatus *Cope*		
" baldwini *Cope*	×	
" stenops *Cope*		
Protochriacus priscus *Cope*	×	
" simplex *Cope*	×	
" attenuatus *O. & E.*	×	
Epichriacus schlosserianus *Cope*		
Incertæ sedis.		
Loxolophus hyattianus *Cope*	×	
Tricentes bucculentus *Cope*		×
" crassicollidens *Cope*		
? Tricentes subtrigonus *Cope*		
Ellipsodon inæquidens *Cope*		
3. CREODONTA.		
ARCTOCYONIDÆ.		
Clænodon ferox *Cope*		×
" corrugatus *Cope*		
" protogonoides *Cope*		
Tetraclænodon floverianus *Cope*		
TRIISODONTIDÆ.		
Triisodon quivirensis *Cope*		
" biculminatus *Cope*	×	×
" heilprinianus *Cope*		
Sarcothraustes antiquus *Cope*		×
" coryphæus *Cope*	×	
" crassicuspis *Cope*	×	
" bathygnathus *Cope*	×	
Goniacodon levisanus *Cope*		
" gaudryanus *Cope*	×	
" rusticus *Cope*		
Microclænodon assurgens *Cope*		
MESONYCHIDÆ.		
Dissacus navajovius *Cope*		
" carnifex *Cope*		×
PROVIVERRIDÆ.		
Deltatherium fundaminis *Cope*		×
MIACIDÆ.		
Didymictis haydenianus *Cope*		
" primus *Cope*		
4. TILLODONTA.		
Psittacotherium aspasiæ *Cope*		
" multifragum *Cope*	×	×
" megalodus *Cope.*		
Hemiganus vultuosus *Cope*		
" otariidens *Cope*	×	
Conoryctes comma *Cope*		×
Onychodectes tissonensis *Cope*	×	
? " rarus *O. and E.*	×	

TABLE III.—*Continued.*

	LOWER.	UPPER.
5. AMBLYPODA.		
TALIGRADA.		
PANTOLAMBDIDÆ.		
Pantolambda bathmodon *Cope*		×
" caviríctus *Cope*		×
6. CONDYLARTHRA.		
MIOCLÆNIDÆ (Incerta sedis).		
Mioclænus turgidus *Cope*	×	×
" zittelianus *Cope*		
" turgidunculus *Cope*	×	
" opisthacus *Cope*		
PERIPTYCHIDÆ.		
Periptychinæ.		
Periptychus rhabdodon *Cope*	×	×
" coarctatus *Cope*	×	
" brabensis *Cope*	×	×
Ectoconus ditrigonus *Cope*	×	
Anisonchinæ.		
? Zetodon gracilis *Cope*		
Haploconus lineatus *Cope*		×
" corniculatus *Cope*		
" angustus *Cope*		
" xiphodon *Cope*		
" entoconus *Cope*		
" cophater *Cope*		
Anisonchus mandibularis *Cope*		×
" sectorius *Cope*		×
" coniferus *Cope*		
" gillianus *Cope*		
" agapetillus *Cope*		
Hemithlæus kowalevskianus *Cope*	×	
" apiculatus *Cope*		
PHENACODONTIDÆ.		
Euprotogonia puercensis *Cope*		×
" zuniensis *Cope*		
" calceolata *Cope*		
" plicifera *Cope*		
Protogonodon pentacus *Cope*	×	
" lydekkerianus *Cope*		
7. INCERTÆ SEDIS.		
Oxyacodon apiculatus *Earle*	×	
Oxyclænus cuspidatus *Cope*		
Paradoxodon rutimeyeranus *Cope*	×	
Carcinodon filholianus *Cope*	×	
Mioclænus interruptus *Cope*		
" minimus *Cope*		
" acolytus *Cope*		
Pentacodon inversus *Cope*		

This geological distribution, made up from the field notes of Cope (Baldwin) and Wortman also probably contains many errors of detail, and is subject to alteration by future discovery. The following are the most important points in the vertical distribution :

1. Among the Multituberculata, the Plagiaulacidæ including Polymastodon are confined to the lower beds, while the Chirogidæ are found in the upper beds.

2. Among the Primates three species of Chriacidæ occur in the lower beds, while other Primates are found in the upper beds.

3. Among the Creodonta the following are recorded from the upper division only: *Clænodon*, *Triisodon* (excepting one species), *Dissacus*, *Deltatherium*. *Sarcothraustes* occurs in both upper and lower.

4. Among the Tillodonta, *Hemiganus* and *Onychodectes* are found in the lower and not in the upper beds.

5. Among the Amblypoda, *Pantolambda* is found only in the upper beds.

6. Among the Condylarthra it is remarkable that the highly specialized *Ectoconus* occurs in the lowermost portion of the lower beds associated with remains of *Periptychus*. *Periptychus*, however, extends also into the upper beds. The specialized *Hemithlæus* is from the lower beds only, while the more simple *Haploconus* and *Anisonchus* have been found both in the upper and lower beds. Among the Phenacodontidæ *Protogonodon* is found only in the lower beds, *Euprotogonia puercencis* only in the upper beds.

III.—SYSTEMATIC DESCRIPTION.

1. Order MULTITUBERCULATA *Cope.*

Family PLAGIAULACIDÆ *Marsh.*

Subfamily POLYMASTODONTINÆ.

The discovery that *Meniscoëssus*[1] of the Laramie is a transition form between *Plagiaulax* and *Polymastodon* removes the latter genus to the Plagiaulacidæ, subfamily Polymastodontinæ, characterized by reduced fourth premolars.

1. *Plagiaulacinæ.*	2. *Polymastodontinæ.*
Early representatives of the Plagiaulacidæ: Premolars, 4–1. Fourth premolars very large and trenchant.	Latest representatives of the Plagiaulacidæ: Premolars, 1. Fourth premolar greatly reduced.

Genus **Polymastodon** *Cope.*

Dentition: $I\frac{2}{1}$, $C\frac{0}{0}$, $P\frac{1}{1}$, $M\frac{2}{2}$. The enlarged anterior pair of incisors vertically striated, enamel wanting on posterior surfaces. Lateral upper incisors (I3) small, conic. First upper molars with three rows of tubercles; second ditto, with two rows and a rudimentary third row.

This last survivor of a great Mesozoic order is represented in the collection by remains of 45 individuals, many of which are exceptionally perfect. The five species established by Cope seem to be valid with the exception of *P. latimolis*, which is doubtfully distinct from *P. taoënsis*. We can now amplify Cope's definitions as follows:

P. foliatus.[2]	*P. taoënsis.*[3]
Of small size. Lower molar tubercles flattened, block-shaped. Cusp formula: first molar, 5 outer, 4 inner; second molar, 4 outer, 2 inner. P4–M2=22 mm.	Jaws robust. Lower first molar much larger than second. Cusp formula: first molar, 7–8 outer, 6 inner. Incisors broad, with enamel band wanting on fang.

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[1] See Osborn, 'Fossil Mammals of the Upper Cretaceous Beds.' Bull. Am. Mus. Nat. Hist., Vol. V, 1893, pp. 312–330.

[2] Am. Nat., 1882, p. 416.

[3] Am. Nat., 1882, p. 684.

P. fissidens.[1]

Of intermediate size. Molar tubercules conic. Cusp formula: first lower molar, 5 outer, 4 inner, 3 additional cusplets. M1, 135 mm.

P. attenuatus.[3]

Jaws slender. Molars compressed in mid-region. Cusp formula: first molar, 9 outer, 6–7 inner; second molar, 5 outer, 4 inner. Incisors narrow, with enamel extending to base of fang. Upper incisor grooved laterally.

P. latimolis.[2]

Jaws robust. Lower first molar slightly larger than second. Cusp formula: 1st molar (?), 5 outer, 6 inner.

P. selenodus, sp. nov.

Laterally compressed. Lower molar tubercles crescents, opening backwards. Cusp formula: first molar, outer 7, inner 6. M1, 2 mm.

In general *P. foliatus* is the most primitive type, distinguished by small size and very few tubercles. *P. fissidens* is somewhat larger, with the same number of full sized conic tubercles, but with accessory tubercles. *P. selenodus* is still larger, with more numerous crescentic tubercles; *P. attenuatus* is laterally compressed with long enamel bands on the incisors; *P. taoënsis* and *P. latimolis* are robust, with short enamel bands on the incisors.

Polymastodon attenuatus *Cope.*

This species is represented by the dentition of a left mandibular ramus (No. 967) and by a complete upper dentition (No. 970). Also by Nos. 730, 720, 743, 734. The lower teeth correspond in general to the description of Cope;[4] the incisor is very long and slender, with well-defined grooves, multiplying towards the fang; the enamel band is confined to half the section. The fourth premolar is narrow, and exhibits three minute apical cusps, the second and third being separated by a deep notch. The first molar is long, narrow, and compressed in the middle; the second is short and rounded.

The complete upper dentition is of great interest. The large incisor (? 2) is rather slender, sharply grooved, restricted enamel band and a deep postero-external groove. The lateral incisor (? 3) is a very small conical tooth, compressed antero-posteriorly, with its enamel confined to the anterior surface, probably as an instance of 'meristic repetition.' The fourth premolar is small,

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[1] Am. Phil. Soc., 1883, p. 322.

[2] Am. Nat., 1885, p. 385.

[3] Am. Nat., 1885, p. 494.

[4] Am. Nat., 1885, p. 494.

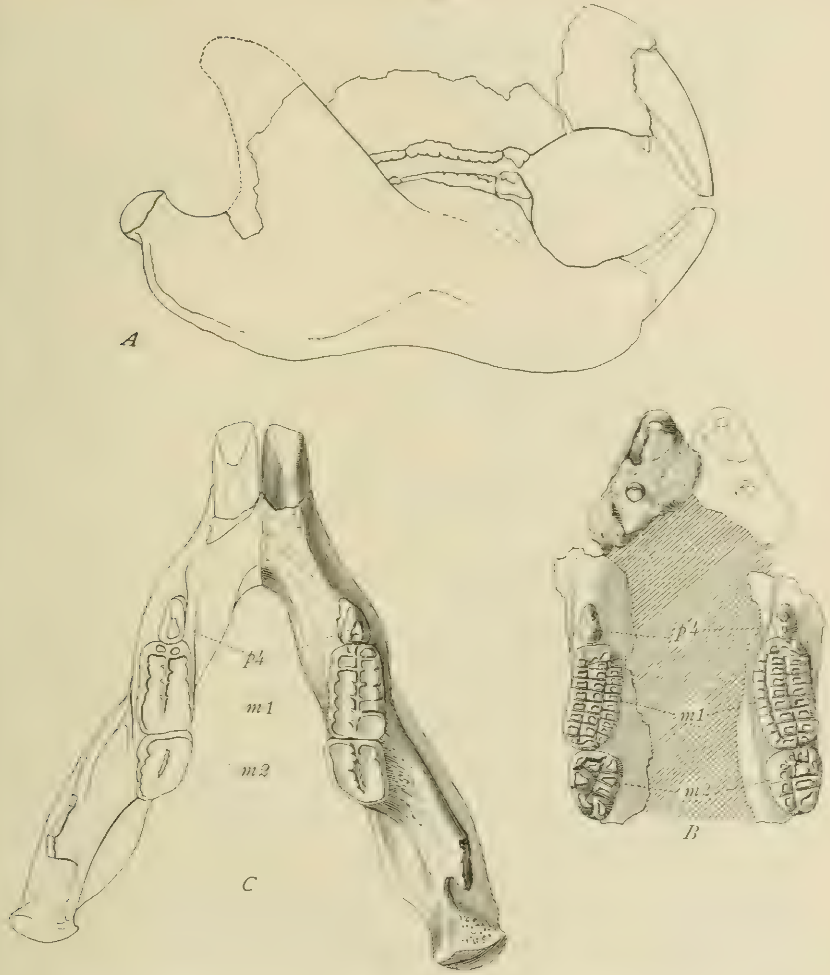

Fig. 1. POLYMASTODON. A, *P. attenuatus*, composition side view of upper and lower jaws. B, Superior dentition, crown view. C, *P. taoënsis*, lower jaws, crown view. Two-thirds natural size.

conical, with two apical cusps. The first molar is long, rather narrower than in *P. taoënsis*, and somewhat compressed in the middle; the second is sub-triangular, narrowing posteriorly, and with only one and one-half cusps in the outer row. (Fig. 1 *B*.) The molar cusps are transversely oval, with some tendency to exhibit crescents opening forwards in the upper series and backwards in the lower series, as in *Meniscoëssus.* The cusp formula is:

	Lower Molars.		Upper Molars.		
	Outer.	Inner.	Outer.	Middle.	Inner.
First molar.....	9	6–7	9	9	10
Second molar...	5	4	1–2	4	4–5

Polymastodon taoënsis *Cope.*

This species includes the robust types, and is represented by numerous specimens—Nos. 742, 746–8, 750, 753, 721–3, 725–32, 735, 736, 743, 968.

The lower jaws are robust; the coronoid rises from the outer side of the third molar and posterior half of the second; the pterygoid fossa is deeply excavated, and the masseteric fossa is a broad concavity; the lower border of the jaw is thus broad and flat and ⊥ shaped in section; the condyle is oval and its long axis is placed obliquely, not antero-posteriorly as in the Rodents. The obliquity is greater in some specimens (No. 734) than in others. When the jaws are spread as in Fig. 1 *C*, the opposite molars are exactly parallel with each other, and the condyles are transverse, but the antero-posterior grooving of the molars is proof of motion in the same direction. A marked feature of the jaw is that the coronoid rises on the outer side of the second molar. The lower incisors are broader than in *P. attenuatus* and are readily distinguished by the fact that the enamel terminates at or above the alveolar border, and does not extend down upon the fang. The cusp formula of the molars as compared with *Meniscoëssus* is:

	Lower Molars.		Upper Molars.			
	Outer.	Inner.	Outer.	Middle.	Inner.	
First molar...	7–9	6–7	9	9–10	10–12	*Polymastodon taoënsis.*
Second molar.	4	4	1	4	5	
First molar...	5	4	7	7	7	*Meniscoëssus conquistus.*
Second molar.	4	2	3	4	4	

Although the lower molars exhibit typically but two rows, we occasionally observe (No. 725) a postero-external accessory row upon the first molar, and upon the first and second molars (Nos. 725, 731). The form of the cusps is occasionally subcrescentic.

The comparison with *Meniscoëssus* shows an average *addition* of two cusps to the first molars in both jaws, and an apparent degeneration of the outer row in the second upper molar, so that this tooth is relatively simpler in *Polymastodon* than in the older genus *Meniscoëssus*.

Polymastodon fissidens *Cope.*

This species is represented by a fragment of the left mandible (No. 751), containing the base of P4 and the much worn and fissured crown of the first molar. This tooth is a trifle larger than that in Cope's type, and the cusp formula is apparently 6 outer, 5 inner; so that there is some doubt as to this specific reference.

Polymastodon selenodus, sp. nov.

The type (No. 749) lower molar is widely distinct from the above in the *crescentic* form of its molar cusps.

The anterior cusps are distinct, the posterior are low and irregular; there are 7 in the outer and 6 in the inner row; the anterior border is convex, the posterior is flattened, giving a subcrescentic section, which reminds us strongly of the cusps of *Meniscoëssus conquistus* of the Laramie. The fourth premolar is very small.

Fragments of a *Polymastodon* skull (No. 734), undetermined, exhibit a broad molar shelf below the orbit. Another skull (No. 721) is still embedded in a very hard matrix.

2. Order PRIMATES.

We find in the Puerco numerous remains of the Primates, and there is every reason to believe that these animals were both abundant and highly specialized or modernized. At present, however, there is no satisfactory means of determining as regards several of these types whether they belong to the Lemuroid or to the Anthropoid phylum ; we refer especially to *Tricentes* Cope, to the related *Indrodon* Cope, and to *Mixodectes.* Of *Indrodon* we have the first remains of the skeleton which have been found in the Puerco, by far the oldest Primate skeleton known. Apparently related in dentition to modern Lemurs are the *Chriacidæ*, a family including larger forms which we remove from the Creodonts where they have been placed by Cope, and provisionally refer to the Primates.

1. *Chriacidæ.*	2. *Anaptomorphidæ.*	3. *Mixodectidæ.*
Incisors normal. Premolars, 4. Premolars spaced. Pm4 without tritocone. Molars tritubercular.	Incisors normal, $\frac{2}{2}$. Premolars, 3–2.	A pair of incisors enlarged. Premolars, 3.

Family ANAPTOMORPHIDÆ *Cope.*

Genus **Indrodon** *Cope.*[1]

(?) Dentition : $I^{?}$, $C\frac{1}{}$, $P\frac{3}{}$, $M\frac{3}{}$. Premolars spaced and conic. Upper molars with flattened outer cusps, a rudimentary postero-internal tubercle or hypocone. This type is distinguished from *Anaptomorphus* by absence of internal lobe upon third superior premolar, and by spacing of premolars.

Indrodon malaris *Cope.*

In Cope's type, a fragmentary skull, the maxillo-premaxillary suture cannot be made out ; the homologies of the anterior teeth are therefore uncertain ; they apparently represent two incisors, and a canine. The second and third upper premolars are small, conic and widely spaced ; the fourth premolar only has a conic internal lobe. The true upper molars are low-crowned and subtriangular ; the outer cusps are flattened and there is a wide external cingulum, marked by minute cingules. The intermediate tubercles are absent or worn off in the type ; there is also a faint postero-internal cingulum, and the hypocene is represented as a cingular cusp upon the first and second molars. The third molar is somewhat smaller than the others, and there is no such great inequality in size as we observe in *Tricentes bucculentus*, or in *T. inæquidens*. This description refers to Cope's type.

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[1] Proc. Am. Phil. Soc., 1883, p. 318.

Skeleton of Indrodon.—The reference to *Indrodon*, of the skeleton No. 823, is somewhat doubtful, because the upper molars associated with the skeleton are so much worn.

The material consists of fragments from all parts of the skeleton, which were collected by Dr. Wortman with the greatest care, including: Teeth, superior P4–M3 inclusive; inferior P3 and M1; part of the lower jaw, and isolated M1, and P3. Of the vertebral column are preserved: cervicals, 2; dorsals, 6; lumbars, 4; sacrals, 1; caudals, 7; these are mostly centra with portions of the neural arches. Of the appendages, portions of the scapula, humerus, radius and ulna, metacarpals and phalanges are preserved. Of the hind limb parts of the ilium, femur, tibia and fibula and tarsals are preserved.

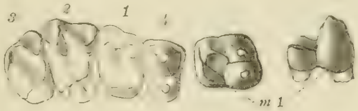

Fig. 2. *Indrodon malaris*. Superior molars, and an inferior true molar. Twice natural size.

The animal (No. 823) was about half the size of *Lemur varius*, with slender limbs and a long powerful tail; in fact it closely resembled some of the living Lemurs. The principal characters are as follows:

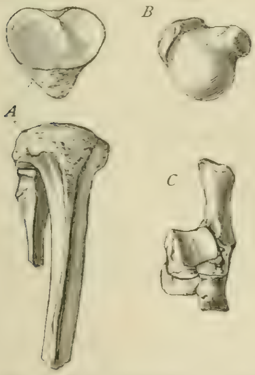

Fig. 3. *Indrodon malaris*. Portions of the skeleton: A, Proximal portion of right tibia and fibula; B, Head of humerus; C, Left tarsus. Natural size.

Dentition.—The fourth upper premolar has a sharp prominent external protocone and an internal deuterocone, with the rudiment of the tritocone. The molar crowns, although broken, indicate that they were tritubercular, wider transversely, and more compactly placed than in the *Indrodon* type, although of the same measurements.

The intermediate tubercles are indistinguishable, owing to excessive wear.

The posterior portion of the lower jaw contains the worn crowns of the first and second molars.

Fore Limb. — The fore limb characters are the following: Scapula, with an obtuse coracoid; humerus, with tuberosities not very prominent, but exhibiting a marked deltoid ridge extending from the greater tuberosity on the outer side of the front face of the shaft, and a marked ridge extending from the lesser tuberosity down the inner side. A similar relation of these ridges is very characteristic of the Lemurs, and is also seen in some of the true Monkeys. In most of the Monkeys, however, the deltoid ridge occupies a median position on the front face of the shaft, and the lesser ridge is reduced or wanting. Distally the humerus presents a strong entepicondylar foramen. The head of the radius is oval, and the ulna has a short olecranon.

Hind Limb.—The ilium has an imperforate acetabulum and a wide cotyloid notch. The femur exhibits three trochanters, the third trochanter extending about half-way down the outer side of the shaft; the head exhibits a pit with a round ligament; the cnemial crest of the tibia is prolonged down the front face of the shaft. The fibula is well developed. The astragalus exhibits the astragalar foramen, and a large fibula facet, similar to that in *Lemur varius*; it has a deep posterior groove for the flexor tendon; distally the astragalus has a short neck and a convex navicular facet. The cuboid is subquadrate in form. Unlike the Condylarthra articulation, the calcaneo-cuboidal facet is nearly flat.

Vertebræ.—The axis exhibits a short odontoid process; the cervical centra are flat. The dorsal centra are triangular in form; the lumbar centra are more elongate and flattened. The detached zygapophyses which belong in the posterior dorsal or lumbar region, exhibit convex vertically placed facets. There is apparently but a single sacral vertebra. The caudals are long and well developed.

? UPPER DENTITION OF INDRODON.—Portions (No. 833) of the maxillæ and of the lower jaw with certain teeth, were found with remains of two skeletons, a larger (No. 833) and a smaller (No. 834).

The identification of No. 833 with *Indrodon* is not absolute ; it is based upon the likeness of the superior molars (Fig. 4) to the somewhat fractured crowns in Cope's type. It is rendered doubtful by the compactly placed lower premolars. The fourth upper premolar is triangular, with a complete investing cingulum, a high protocone, a deuterocone, and incipient tritocone. The molars are beautifully preserved ; they consist of a perfect trigon with a detached spur-like hypocone upon the first and second molars ; the external cusps are subcrescentic, and in the sharp external cingulum we observe a distinct mesostyle and less prominent para- and metastyles ; the intermediate tubercles are developed upon the spurs between the external and internal cusps. The jaw contains the alveoli of a small lateral incisor, a larger canine, a small one-rooted premolar ; next a two-rooted premolar, followed by a premolar crown which is either P3 or P4 ; this has a sharp crown and a low heel. If this is the fourth premolar it is closely similar to that of *Anaptomorphus*.

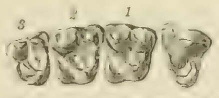

Fig. 4. *Indrodon malaris.* Crown view of last superior premolar and true molars. Twice natural size.

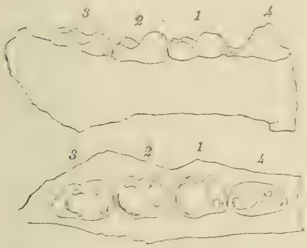

Fig. 5. *Indrodon malaris.* Lower jaw, internal and upper view. Natural size.

A comparison with *Anaptomorphus homunculus*[1] of the Wahsatch shows a very similar configuration of the lower jaw, and probably a similar lower formula, P3, M3. The upper teeth of this specimen (No. 833) differ from those of *A. homunculus* in the much more prominent hypocone spur.

The humerus associated with this specimen also has the double ridge observed in No. 823.

Incertæ sedis.—The skeleton (No. 834) found with this type is of smaller size and presents many differences from that of No. 823.

Lower Jaw.—Fig. 5 represents a lower jaw (No. 829), which we provisionally refer to this genus owing to the similar dimensions of the lower molar series with those in the fractured jaw attached to Cope's type skull. The Pm4 is a rounded cone with a faint deuteroconid and anterior basal cusp; the talonid is broad and basin-shaped. The molars are distinguished by the absence or vestigial condition of the paraconid, the elevation of the trigonid, the rather depressed but distinct hypoconid from which extends inwards a broad internal basin representing the fusion of the hypoconulid and entoconid. In M3 the hypoconulid is a distinct cusp.

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[1] Bull. Am. Mus. Nat. Hist., 1892, p. 103.

An isolated single molar (No. 829*a*) shows the same characters.

Family CHRIACIDÆ, fam. nov.

This family includes forms more primitive than the *Adapidæ* but with a similar dental formula.

It is exceedingly difficult in the present state of our knowledge to decide with certainty as to the ordinal affinities of the genera which Scott[1] has included in the family Oxyclænidæ. We think it probable, however, that *Chriacus* and its allies are more closely related to the Primates than to any of the Creodonta to which Cope has referred them. The type species of the genus *Chriacus*, namely, *C.* (*Pelycodus*) *pelvidens*, was in fact at first included by Cope with the Lemurine like *Pelycodus*. Scott has suggested the Primate relationship of these forms. Schlosser has also observed the resemblance in the shape of the jaw in *Chriacus* to that of *Necrolemur*. We here discuss the evidences of Primate relationship.

Of the three points spoken of by Scott as separating *Chriacus* from the Lemurs, namely, (1) the character of the jaw symphysis, (2) spacing of the inferior premolars, (3) the presence of the paraconid; the second character at least occurs in the Bridger genus *Tomitherium*, which is an undoubted Primate. Again, among the recent Lemurs, the last two inferior premolars are spaced in some species of *Lemur*, while the paraconid is present in *Tarsius*. Thus the difficulties raised by Scott are all removed.

As remarked by Scott the superior molars of *Chriacus* are surprisingly like those of certain Lemurs, and it is to be emphasized that they resemble those of the Lemurs more closely than those of the Creodonts. Again, we have some remains of the skeleton of a form, probably belonging to the Chriacidæ, which resembles corresponding parts in the recent Lemurs. There are apparently two types of mandibular symphysis among the primitive Primates of the Puerco; in *Chriacus* this portion of the jaw is long and narrow. This is the most primitive condition, and common to many Puerco forms. The other type (Anaptomorphidæ, Mixodectidæ) presents the jaw at the symphysis as deep as below the last lower molar.

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[1] These genera employed by Scott upon types of Cope's species of *Mioclænus*, *Chriacus*, and *Tricentes* are as follows: *Oxyclænus*, *Chriacus*, *Protochriacus*, *Epichriacus*, *Pentacodon*, *Loxolophus*, *Tricentes*, *Ellipsodon*.

Genus **Chriacus** *Cope.*

Pelycodus Cope, in part.

Dentition: $P\frac{4}{4}$, $M\frac{3}{3}$. Superior true molars tritubercular with hypocone, and on second molar an antero-internal cusp (protostyle); third upper molar reduced in size. First and second inferior premolars spaced, fourth with a deuteroconid and heel. Trigonid of inferior molars higher than talon; paraconid present.

The superior molars in this genus especially resemble those of the genera *Lemur* and *Galago*. As compared with the upper molars of such a typical Creodont as *Deltatherium* those of *Chriacus* differ (1) in their more square form; (2) in the rounded shape of the external cusp; (3) in the large development of the supplementary internal cusps. The lower true molars of *Chriacus* have the trigonid less elevated than in *Deltatherium*, and the talon, similar in shape to that of *Pelycodus*, resembles that of the Lemurs in being very broad and wide.

Chriacus baldwini *Cope.*

There are only portions of jaws of this species in the collection (Nos. 789, 811 and 812). In the *C. baldwini* the first premolar of the lower jaw is separated by a wide interval from the second; the second and third are nearer together, and there is no interval between the third and fourth. The crown of the fourth premolar is high, recurved, and much elevated above that of the first true molar. The mandible is elongated and becomes slender in the premolar region; its general form closely resembles that of *Protochriacus priscus*.

Genus **Protochriacus** *Scott.*

Superior molars with no protostyle, and hypocone very weakly developed. Inferior true molars with trigonid little raised above talon. (Type, *P. priscus.*)

This genus slightly differs from *Chriacus* in the more primitive structure of its upper true molars, which have the supplementary antero-internal cusp hardly developed at all. The inferior true molars differ widely from those of *Chriacus*, and these teeth in the two species included by Scott in *Protochriacus* are quite different in structure, and further investigation may prove that they belong to distinct genera.

Protochriacus priscus *Cope.*

Inferior true molars with no external cingulum ; trigonid only slightly raised above talon. Talon of last lower molar very wide and deep, with hypoconulid.

The material in our collection pertaining to this small species is very abundant; there are no less than a dozen fragments of jaws and upper teeth (Nos. 802, 803, 817, 818, 939). The first and second inferior premolars are spaced, and the last premolar has no deuteroconid. The paraconid is small and placed between the proto- and metaconids, but nearer the latter cusp. The mandible is long, narrow, and tapers gradually to the symphysis, which is much narrower than the portion below the true molars. The inferior true molars of this species are more of the Lemur type than those of the allied species, viz., *P. simplex*. The talonid is wide and is more extended transversely than the trigonid ; the cusps forming the border of the basin-like talon are not distinctly separated from each other as in *P. simplex.*

Protochriacus attenuatus, sp. nov.

Paraconid well marked, on a line with metaconid, trigonid not raised above talon, hypoconulid distinct.

The type of this new species of *Protochriacus* is specimen No. 790. This specimen is smaller than the *P. priscus;* the jaw is very narrow and slender. The crescents of the inferior true molars are strongly marked, and the cusps are sharper than in the allied species. The paraconid is well marked on the first true molar, but is rudimentary on the second. The shape of the talon of the last tooth of this series is quite different from that of *P. priscus*.

Measurements.

	M.
Total length of M1 and M2	.012
Depth of jaw below M1	.008

Protochriacus simplex *Cope.*

Inferior true molars with trigonid much raised above talon, paraconid well developed. A strong external cingulum on all the lower true molars. Talonid of last lower molar much smaller than trigonid, with hypoconulid well constricted off.

The type of lower molar found in this species is more like that of the typical Creodonts (*Deltatherium*); the trigonid is high and the anterior portion of the same is more thrown out than in *P. priscus*, thus giving the teeth a more trenchant function. One specimen (No. 799), among others, in the collection of this species, has the upper molars associated with the lower teeth. The superior molars are much extended transversely, more so than in *P. priscus ;* the external cusps are round in section, and the postero-internal cingulum is not as much developed into a hypocone as in *P. priscus*. In specimen No. 793 the jaw is much deeper than in No. 794, however the teeth are nearly of the same size ; great variation in the depth of the jaw is often displayed by the same species of Puerco mammals.

Genera INCERTÆ SEDIS.

Genus **Tricentes** *Cope.*[1]

Dentition : I?, $C\frac{1}{1}$, $P\frac{3}{3}$, $M\frac{3}{3}$. Premolars spaced and conic. Molars with rounded tubercles, hypocone well developed. Molars irregular in size ; third molar reduced. Trigonid slightly elevated. Paraconid reduced.

[1] Proc. Am. Phil. Soc., 1883, p. 315.

Tricentes bucculentus *Cope.*

The third upper premolar triangular ; the fourth with a compressed protocone and a large internal cusp ; first and second upper molars with hypocone, third small, tritubercular ; lower molars with tubercular talonid.

There is only one example (No. 784) of this species in the collection ; this includes both upper and lower sets of teeth, and as the latter have not been described, this specimen is of importance.

The roots of the upper canines of both sides are preserved, showing that these teeth were quite long and powerful ; they are separated from the second premolar by a wide diastema. The first premolar has disappeared. The crowns of the second and third premolars are broken off, the fourth premolar has a high protocone and a well-marked deuterocone. A very minute cingular hypocone is present on the first molar, but on the second molar the cingulum is not so distinctly developed into a hypocone. The last upper molar is small and has two external cones. The great size of M2 as compared with M1 and M3 is to be noted in this species.

The lower jaw contains the crowns of the third premolar and the second and third molars. The crown of Pm3 is very slender, without a heel ; there is some indication that there was a minute second premolar in front of this tooth. The second lower molar has the trigonid slightly raised above the talon, which has a different form from that of *Protochriacus;* the paraconid is present, but greatly reduced. In *T. bucculentus* the talon is notched at its posterior border by a posterior cingulum which extends to the slightly developed external cingulum. The last lower true molar has an elongated talon, as in the Bridger Monkeys ; this extends postero-internally into a high ridge upon which the entoconid is not differentiated, although the hypoconulid is well marked. The lower true molars of *Tricentes* remind one strongly of those of *M. turgidus.* The jaw is long and deep beneath Pm1 as it is beneath the last true molar.

Incertæ sedis.—A lower jaw (No. 815) containing an incisor, canine and two molars is provisionally placed here. The incisor is small and spathulate. The molar tubercles are all upon the same level, the trigonid not being elevated.

Genus **Oxyacodon,** gen. nov.

Fourth lower premolar strongly compressed laterally, with only a very minute talon, no deuteroconid. Crowns of inferior true molars high with sharp cusps, trigonid not elevated above talonid, paraconid reduced. Hypoconulid of last lower molar high and sharp.

The type of this new genus is a fragment of a lower jaw bearing the last lower premolar and first two molars (No. 816). There is also another portion of a jaw which we refer to this genus (No. 806). The true molars in this genus resemble somewhat those of *Anisonchus*, but the structure of the last premolar is widely different. The general structure of the teeth differs decidedly from that seen in *Chriacus* or *Tricentes*, and appears to be more of the insectivorous type.

Oxyacodon apiculatus, sp. nov.

Last lower premolar higher than the first true molar, and the crown of same as long antero-posteriorly as the latter. Hypoconulid of M3 well constricted off ; very sharp and curved forwards.

The last lower premolar is flattened with sharp anterior and posterior cutting edges ; there is only a very slight enlargement behind. This tooth differs from that of *Protochriacus* in being more flattened and trenchant. The second true molar is high and narrow with four principal cusps inclined forward ; these cusps are also less connected than in the typical genera of the Chriacidæ. The structure of the talon of the last lower true molar is peculiar, in arising from the height of the hypoconulid, which is unusually sharp and pointed. The jaw is deep, and was probably short. This character relates this genus to the Primates.

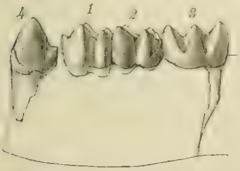

Fig. 6. *Oxyacodon apiculatus.* Portion of left lower jaw, external view. Composition. One and one-half natural size.

? Chriacus ——.

A jaw (No. 835), with fragmentary remains of a skeleton, is of importance. The jaw is not at all like that of the recent Lemurs, but resembles in form that of *Chriacus* and its allies ; that is to say, the symphysial part is much elongated, slender and slopes gradually to the symphysis, instead of being deep and abrupt as in the recent Lemuroidea and Anthropoidea. Unfortunately the teeth are all absent from this specimen, so that we cannot identify it with certainty. The alveoli of the premolars are quite distinct, the first is placed close to the canine, the second is spaced as in *Chriacus*, the last three premolars are two-rooted.

Measurements of Jaw.

	M.
Length of inferior molar series........ ...	.040
Depth of jaw at M3	.010
" " " symphysis................	.008

The part of the humerus associated with this jaw is extremely long, and it is of interest to note that the two proximal crests so characteristic of recent Lemurs are present on this specimen.

3. Order CREODONTA *Cope.*

Family ARCTOCYONIDÆ *Cope.*

Genus **Clænodon** *Scott.*

Miochenus Cope, in part.

Superior molars subquadrate in outline, with well-developed hypocone on the first and second. Inferior premolars simple in structure, last without metaconid. Inferior true molars with trigonid on a level with talonid, and cusps of same not distinctly differentiated. Borders of molars and edges of premolars serrated.

This genus is easily distinguished from other Creodonta of the Puerco by its low-crowned molars, in which the cusps are little raised above the general surface of the teeth. The crowns of the lower premolars are sharp and high, and the last tooth of this series is without a heel. *Clænodon*, as shown by Scott, is closely related to the European genus *Arctocyon.*

Clænodon ferox *Cope.*

Crown of last inferior premolar much higher than that of first true molar, and provided with a well-marked external cingulum. Second and third inferior premolars much reduced in size. Crowns of lower true molars very flat, with cusps hardly distinguishable ; hypoconulid of M3 large and covered with crenulations.

There is only one specimen of this rather rare form in the collection (No. 772) ; this is a jaw in which the last three premolars and the true molars are well preserved. The first two premolars are much smaller than the last tooth of this series ; the crowns are rather high and compressed. The fourth inferior premolar has a high crown which is recurved. A peculiarity of the premolars is the serration of their anterior and posterior edges, as in the Reptilia. This serration can be plainly felt in running the finger over the edges of the teeth, although not well marked to the naked eye.

The structure of the crowns of the lower true molars reminds one strongly of those of the Wahsatch *Anacodon ;* the borders of these teeth are slightly raised above the general surface, but not produced into well-marked cusps. The last lower true molar is unusually flat and ill defined in the structure of the crown ; it has five slight elevations corresponding to the cusps of more highly developed forms, and the enamel surrounding the cusps is much crenulated, like that of *Anacodon.* The hypoconulid is peculiar in being very flat and much extended posteriorly.

It is interesting to be able to trace out another line of descent from a Puerco to a Wahsatch form, and we think it certain that *Clænodon* is the ancestor of the peculiar Wahsatch type *Anacodon.* Only recently Osborn and Wortman[1] have removed *Anacodon* from the Condylarthra and placed it in its true position near *Arctocyon.* This is indicated not only by the structure of the molars, but by the incipient atrophy of the premolars.

The anterior lower premolars of *Clænodon* are very small and are undergoing a rapid reduction in their size; the first lower premolar is still present in *Clænodon,* but absent in *Anacodon.* The lower true molars in these genera resemble each other very closely in structure, and in both the crowns are much flattened and covered with prominent crenulations of the enamel.

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[1] Bull. Am. Mus. Nat. Hist., 1892, p. 115.

Family TRIISODONTIDÆ *Scott.*

Genus **Triisodon** *Cope.*

Triisodon biculminatus *Cope.*

A fragment of a lower jaw (No. 774), with the true molars intact, is in the collection, and probably belongs to this species. As in Cope's type specimen, the talonid is largely developed, and the entoconid is not distinctly separated from the hypoconulid. The paraconid of the first true molar is submedian in position and well separated from the cusps behind ; on the second and third molars this cusp is only weakly developed. The hypoconulid of the last inferior true molar is semicircular in form, convex posteriorly, and concave anteriorly. Traces of the talonid on the last inferior premolar are preserved, showing this to have been much extended behind as in *Triisodon quivirensis.*

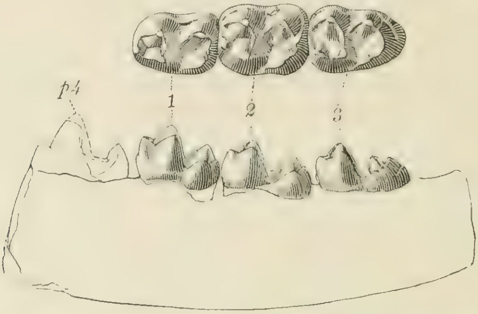

Fig. 7. *Triisodon biculminatus.* Internal and crown view of inferior molars. Natural size.

Genus **Sarcothraustes** *Cope.*

Mioclænus Cope, in part.

Dentition : $I\frac{?}{?}$, $C\frac{1}{1}$, $P\frac{3}{4}$, $M\frac{3}{3}$.

Superior true molars with paracone and metacone conical and equal in size. Last superior premolar not molariform, and same tooth of the lower series with talonid consisting of two cusps. Inferior true molars with trigonid raised above the talonid, the former consisting of three cusps with the protoconid much larger than the para- or metaconid. Metaconid distinctly separated from the protoconid and on the same fore and aft line with the paraconid.

Individuals of the genus *Sarcothraustes* are the most numerous of any of the Puerco Creodonts. This genus is very closely related to *Triisodon*, and is difficult to separate generically from *Goniacodon.*

Sarcothraustes antiquus *Cope.*

This species is represented in the collection by a single jaw (No. 785). This specimen has only three teeth preserved, the two posterior being true molars, but they are not well enough preserved for a detailed description. However, from their worn surface, we think it probable that they resembled in structure those of *S. coryphæus*. The tooth which Cope in his type specimen identified as the first true molar, is really the last premolar; and in the American Museum specimen there are the alveoli for three premolars anterior to the latter, thus proving that *Sarcothraustes* had a full complement of premolars below. The last true molar is absent in this specimen.

Sarcothraustes coryphæus *Cope.*

Numerous remains of this species are to be found in the collection, it being represented by more specimens than any other Creodont. Of these, Nos. 764, 762, 765 and 766, are the best preserved. In No. 764 fragments of the skull with the greater part of the upper dentition are present.

Dentition.—The canine is small and weak in this species, and diverges considerably from the palate ; behind this tooth there are alveoli for two premolars, the last upper premolar being well preserved. This proves conclusively that this genus has only six upper teeth behind the canine, or the same number as in the Bridger *Mesonyx*. It differs from *Mesonyx* in the fact that the last upper premolar is not molariform. The last upper true molar in our specimen has two external cusps. The metacone is smaller than the paracone. Specimen No. 762 presents both upper and lower teeth from the same individual; the lower jaw of this specimen belongs to the *S. bathygnathus* type. This is a remarkable jaw, owing to the small size of the teeth and the great depth and length of the mandible. The angular portion of the jaw is much extended beyond the teeth and is very heavy. The superior molars found with this jaw are only slightly larger than those of *S. coryphæus*, and we believe accordingly that the specific character upon which the *S. bathygnathus* has been proposed by Cope is merely a case of individual variation. In fact, another jaw in the collection (No. 765), is intermediate in dimensions between the typical *S. coryphæus* and *S. bathygnathus*. The lower teeth of *S. coryphæus* are easily distinguished from those of *Dissacus carnifex* by their tuberculated talons, which in the latter form are trenchant. The presence of the hypoconulid on the last lower molar is a marked character of the genus *Sarcothraustes*.

A portion of a cranium exhibits a much elongated, thin and high sagittal crest. The postglenoid process is more extended transversely than in *Felis*, and resembles more in form that of the carnivorous Marsupials. The lower half of a humerus was found with this specimen, and may belong to the same individual. As compared with the size of the skull, it is very small and weak. The deltoid crest is high and extends far down on the shaft. An entepicondylar foramen is present, and the radial trochlea is much extended and slightly convex.

Family MESONYCHIDÆ *Cope*.

Genus **Dissacus** *Cope*.

Dentition: $I^{?}$, $C\frac{1}{1}$, $P\frac{4}{4}$, $M\frac{3}{3}$. Superior true molars with metacone much smaller than paracone. Last upper molar much reduced in size. Lower true molars with protoconid larger than anterior basal tubercle paraconid, and on the same straight line with it. Metaconid present on second inferior true molar, and may be absent on the first and also on the last tooth of this series.

Dissacus carnifex *Cope*.

This species is represented in the American Museum collection by portions of two skeletons, Nos. 777 and 776. The most complete specimen, No. 777, consists of the lower teeth with parts of the skeleton, including a nearly complete carpus and some of the tarsal bones. The importance of this specimen will be appreciated when it is known that it is the most complete skeleton of a Creodont ever discovered in the Puerco Beds.

Dentition.—The upper dentition will be described from specimen No. 776. In this example the teeth are not attached to the maxillary bone, and it is with some difficulty that we are enabled to place them in their proper relation to each other. It is quite certain, however, that with the possible exception of the first upper premolar, all the teeth to be described are properly identified. The supposed first upper premolar is somewhat elongated from before backwards, consisting of a protoconid and a small talon. In the second premolar the principal cone is somewhat triangular in shape, with the heel placed at the postero-external border of the tooth. The third premolar has a small internal cone, with also an antero-external basal cusp. The fourth premolar has a tritocone, and also a postero-intermediate tubercle.

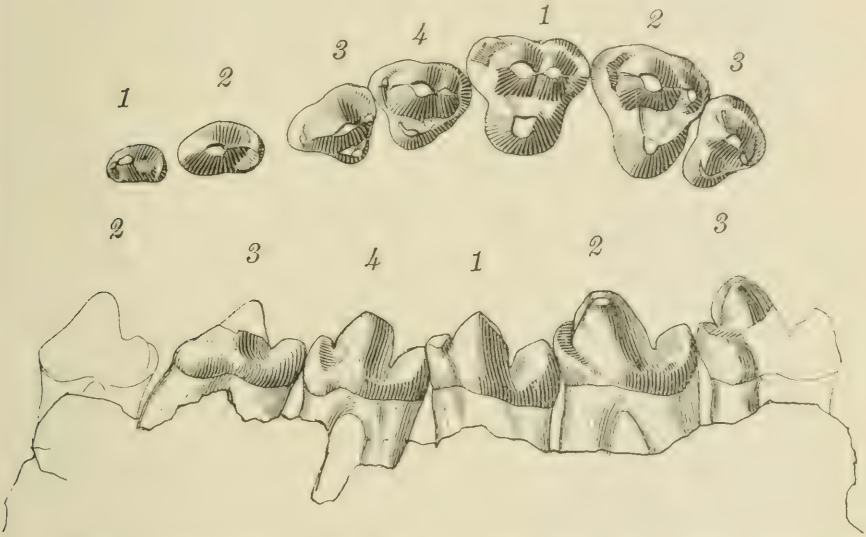

Fig. 8. *Dissacus carnifex.* Crown view of superior, and internal view of inferior molars. Natural size.

The upper true molars of *Dissacus carnifex* resemble closely those of *Pachyæna ossifraga.* This is shown in their much enlarged paracones and the small size of the metacone. In the last upper molar of *D. carnifex* the metacone is rudimentary, and the whole tooth is much reduced in size. The third lower premolar exhibits no anterior basal cusp, a character in which our specimen differs from the type of *D. carnifex* of Cope.[1] However, in *D. navajovius*, the smaller species of this genus, the third lower premolar is without an anterior basal cusp. The total length of the lower teeth in the American Museum specimen is greater than in Cope's type of *D. carnifex*. We believe that these different characters are individual variations of the same species, and cannot be treated as of specific value. In the American Museum specimen of *D. carnifex* both the last two lower true molars have well-developed metaconids, but in Cope's specimen of this species the metaconid is absent on the last molar.

Skeleton.—The distal portion of a humerus is preserved; this is very broad and heavy, with a prominent entepicondyle. The internal flange of the humerus is strongly marked, and the external trochlea for the radius is convex and prominent. The proximal end of the radius is much extended transversely, and below this portion the shaft is flattened, as in the plantigrade Carnivora. The bicipital tubercle of the radius is elongated, and not as prominent as in recent forms. The distal articular surface is very heavy and thick from before backwards. The articular surfaces for the scaphoid and lunar are well marked, but not separated by a ridge. The radial styloid process is only slightly developed, and not elongated, thus differing from such a plantigrade as *Ursus*. The ulna has a heavy, elongated olecranon, and the diameter of its shaft much exceeds that of the radius. The relative proportionate widths, taken by the bones of the forearm in their articulation with the humerus, show that the radius spread over about two-thirds of the width of the humeral trochlear surface, thus largely excluding the ulna from articulating anteriorly with the humerus. The radio-humeral articulation in *Dissacus* is greater than in the Bears, and this denotes less power of supination than in the latter form.

Manus.—The general characters of the manus are very primitive, but in some respects—as for example, in the displacement of the metacarpals upon the podial elements—a considerable modernization has taken place. As compared with the manus of other Creodonts described hitherto, we find that of *Dissacus* closely resembles in its stage of displacement and form of its carpal elements that of *Mesonyx*, as figured by Scott,[1] although *D. carnifex* has not lost the first digit as in *Mesonyx*. The scaphoid is exceedingly flat and elongated transversely, with the internal border much thicker than the external, the superior facet is convex and its backward extension is limited; we cannot with certainty define the facets of the lower surface of the scaphoid; the surface next to the lunar was occupied by a large centrale, although this bone is unfortunately lost. The position of the centrale was like that in the manus of *Mesonyx*, namely, above the magnum and to the internal side of the lunar. We would add that this position of the centrale appears to be typical of the

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[1] See Tertiary Vertebrata, Plate xxv, Fig. 1.

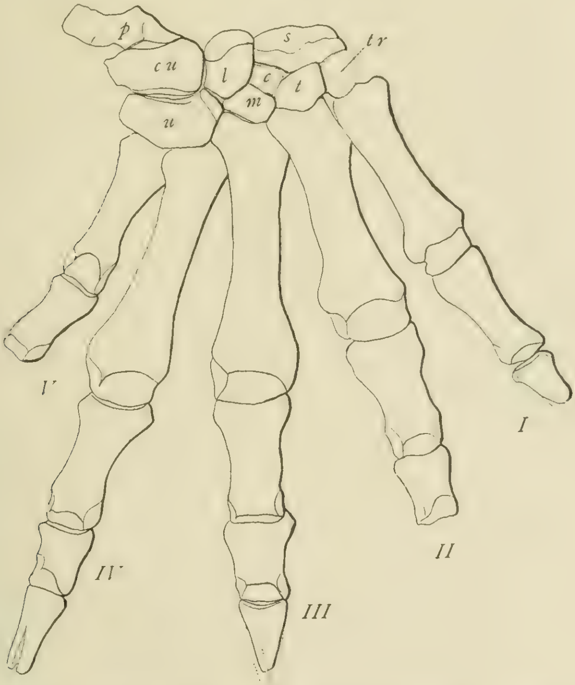

Fig. 9. *Dissacus carnifex.* Right manus, anterior view. Two-thirds natural size.

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[1] Jour. Acad. Nat. Sci. Phila., Vol. IX, Pl. vii, Fig. 1.

family Mesonychidæ, whereas in the Hyænodontidæ the centrale is interposed between the magnum, scaphoid and lunar, but it is placed partially beneath the latter bone. The lunar is convex above, the posterior concave surface sloping abruptly from the anterior portion ; the posterior hook is not prolonged lower down than the apex of the anterior surface ; the inferior articular surface is divided nearly equally; that for the unciform, however, is slightly larger than the facet for the magnum ; the lunar-centrale facet is triangular in form and placed on the internal face of the bone ; the shape of the cuneiform is strikingly like that of *Phenacodus;* it is much elongated transversely, and has only little depth ; the articular cavity for the ulna is deeply concave and only takes up a small portion of the superior surface ; the cuneiform-pisiform facet is very large and oblique to that for the ulna. The pisiform is broad proximally and placed horizontally upon the cuneiform, like that of the Bears. The shape of the unciform is closely like that of *Mesonyx;* it is much extended transversely, and presents a large facet for the lunar ; the internal face has an elongated facet for the third metacarpal, and the inferior surface is flattened and undivided. The unciform in *Dissacus* exhibits no posterior decurved process as in the Perissodactyl Ungulates. The characters of the magnum are of interest, and its relations to the other bones of the carpus are like those of *Mesonyx ;* the proximal facets are divided by a slight ridge, but there is no concavity upon the upper surface as in the magnum of the Felidæ and in that of the Hyændontidæ. The magnum-lunar facet is broader than that for the centrale ; the posterior convexity of the magnum rises only slightly above the plane of the anterior portion of the superior surface ; the form of this carpal is depressed and much extended transversely ; internally it shows a broad and continuous facet for Mc. II.

Owing to the large contact between the Mc. III and the unciform in this type, the magnum is placed higher up in the podium than in *Hyænodon*, and results in crowding out the centrale from the under surface of the lunar. The trapezoid is triangular and depressed ; the trapezium is wanting in this specimen. The proximal portion of the first metacarpal is present, and proves that this digit was of considerable length. The second digit is short, heavy and proximally articulates by a broad facet with the magnum. The third metacarpal has a large articular surface for the unciform, and the magnum facet is obliquely placed. The fourth metacarpal is nearly as long as the third; its proximal facet is flat and horizontal in position. The outer metacarpal is short, stout and proximally, on the external side, exhibits a prominent tubercle.

The phalanges are much elongated, as is the case generally in plantigrade forms. The ungual phalanges are like those of *Mesonyx*, being strongly depressed and split at the end. In the Hyænodontidæ they are shorter and more curved than in the Mesonychidæ.

Pelvis.—One os innominate bone of the left side is in a fair state of preservation ; this shows that the pelvis was much elongated, as in *Mesonyx.* The section of the base of the ilium is triangular, with a very prominent ' rectus ' tubercle. Between the acetabulum and the distal expanded portion of the ilium there is a contracted neck, which is narrow. The acetabular cavity is large and is bordered above by an oblique and broad plate of bone. As compared with the pelvis of *Felis* and *Ursus*, we observe that the ischial segment in *Dissacus* rather resembles that of the Cats; this is shown in the broad descending processes of the ischia and in the prominent tuberosities of the same. A marked feature of this pelvis is the great elongation of the ischial portion as compared with the iliac segment, and we believe this to be a primitive character, for in modern Carnivora the ischial part of the pelvis is much shorter than the iliac. We may add that in the Ungulata, and especially in the more swift-footed members of the same, such as the Artiodactyla, the anterior and posterior divisions of the pelvis are more nearly of the same length than in the Carnivora.

Hind Limb.—The femur is long and its shaft is flattened transversely, this widening of the shaft being in strong contrast to the rounded femora of recent Carnivora ; the third trochanter is prominent and situated at about one-third the length of the shaft below the great trochanter ; the distal articular surface is heavy, and the shaft is much expanded above the condyles. The length of the femur as compared with the tibia is much greater, and they bear the same linear relations to each other as in the plantigrade Carnivora (*Ursus*). The proportions of these bones, and the characters of the manus and pes clearly prove that *Dissacus* was a semiplantigrade. In Scott's restoration of *Mesonyx* the length of the femur is equal to that of the tibia, and as *Mesonyx* was a digitigrade Creodont, we believe these proportions to be correct. The crest of the tibia in *D. carnifex* is not raised and elongated; in this character this bone resembles that of the Bear ; the distal articular surface for the astragalus is nearly plane, although there is a slight median convexity and a faint lateral concavity on each side of the latter; the internal malleolus is broad and much prolonged beyond the articular face.

Measurements of femur No. 777.

	M.
Length	.220
Breadth trans. prox.	.070
" " dist	.054

Pes.—The calcaneum is rather long and slender ; the calcaneal tuberosity is elongated and much compressed, its form more like that of the digitigrade Creodonta ; the ectal facet is placed high above the sustentaculum, being round and not prolonged forward as in the Bear. The transverse diameter of calcaneo-cuboid facet is greater than the vertical, and these relations are the same as those of the Bear. In the digitigrade Carnivora, on the other hand, this facet is nearly round. The astragalus is depressed and broad ; the trochlear surface is only slightly concave, and is bordered posteriorly by a large foramen, which is of such constant occurrence in Puerco mammals ; the large flange-like process bordering the ectal facet is very prominent in this astragalus ; the neck is long and slender, the trochlear surface extending far forward upon it ; this extension of the articular surface of the astragalus has been also pointed out by Cope ; the navicular face is convex from above downwards, and is not separated from that for the cuboid. The navicular has been lost in this tarsus. The shape of the ectocuneiform closely resembles that of *Mesonyx;* it it is divided proximally by two facets, which form a right angle to each other ; the smaller and external is for the cuboid, and the internal that for the navicular; the posterior tuberosity bordering above the groove for the 'peroneus longus' is very large and much extended behind; this is a character common to digitigrade forms like *Felis*, but absent in *Ursus*. The mesocuneiform is high, slender and nearly as long as the ectocuneiform. The entocuneiform is elongated and broad, the posterior facet for the Mt. I is large and deeply concave; this bone in *Dissacus* is flatter and larger than in the Bear. Only the first metatarsal is preserved, and it shows that the hallux was of good size in this type.

Portions of vertebræ, and especially of the caudals, were found with this skeleton (No. 777). The latter are large and much elongated, thus demonstrating that this form had a long tail. The two skeletons of *Dissacus* in the collection vary much as to the lengths of the same bones, but not more than in skeletons of recent Carnivores.

Affinities of Dissacus.—This important discovery of the greater part of the skeleton of *Dissacus* adds much to our knowledge of the relationship of this genus to its probable successors in the Wahsatch and Bridger, *Pachyæna* and *Mesonyx*. The superior molars of *Dissacus* are an exact counterpart, on a smaller scale, of those of *Pachyæna*, although we observe that in *D. carnifex* the last superior molar is more reduced than in the two known species of *Pachyæna*. The upper true molars of *Pachyæna* still have the metacone smaller than the paracone, more especially marked in *P. gigantea*. The inferior true molars of *Pachyæna* are intermediate in structure between those of *Dissacus* and those of *Mesonyx;* this is shown in the reduction of the metaconid; but the relative sizes of the other cusps, as compared with *Dissacus*, are the same. In *Mesonyx*, on the other hand, the two external cones of the upper true molars are equal in size, and the last upper tooth of this series has been lost. The known species of *Pachyæna* show no reduction of this tooth; accordingly another species remains to be discovered in which this tooth is well reduced. As already remarked, the last upper molar of *D. carnifex* is much smaller than the second, and this is what we should expect to find in an ancestor of *Mesonyx*. The presence of the metaconid in a rudimentary condition on inferior M2, and sometimes on M3 in *Dissacus*, proves that the *Dissacus* type of lower molar has been derived from a typical tuberculo-sectorial tooth.[1] As the *Mesonyx* type of lower molar is probably a degeneration from the less specialized tooth of *Dissacus*, so we must concede this to be derived from a tooth with a well-developed trigonid. Such an ancestral type of molar is found in *Sarcothraustes*, where all the cusps of the trigonid are nearly all equally well developed, but already in this genus the superior molars are completely tritubercular, with both external cones equal in size, as in *Mesonyx*.

A comparison of the structure of the manus and pes in *Dissacus* with that of *Mesonyx* shows how closely these two genera are related. The position of the centrale in *Mesonyx* is quite different from that of *Hyænodon*, and resembles that of *Dissacus*. All the carpal elements in *Dissacus* very closely resemble those of *Mesonyx*. It is quite remarkable to find in such an early type as *Dissacus* that the manus has undergone a considerable degree of 'displacement,' as shown in the alternating articulations between podium and metapodium, indicating that *Dissacus* led up to a digitgrade type; in which there was a reduction in the number of the toes, as is observed in *Mesonyx*. The structure of the pes and the relative lengths of the bones of the hind limb to each other, demonstrate that *Dissacus* was a semiplantigrade form; nevertheless the calcaneum is much compressed and lengthened, and indicates the direction in which the foot structure of *Dissacus* was tending. The flat trochlear surface of the astragalus and the large astragalar foramen are typical of the plantigrades of the Puerco; again, as in *Pachyæna* and *Mesonyx*, *Dissacus* has the large astragalo-cuboid articulation. Summing up the changes through which the *Dissacus-Pachyæna-Mesonyx* line has passed, we emphasize the following:

1. Growth of metacone of superior molars, and reduction of the last upper molar.
2. Degeneration of the metaconid of the lower true molars, which is found well developed in *Dissacus*, and reduction of paraconid.
3. Change from the semiplantigrade condition of *Dissacus* to the digitgrade of *Mesonyx*.

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[1] [See Scott, Uinta Mammalia, Trans. Am. Phil. Soc., 1889, p. 473.

Note as cases of persistence the very close resemblance in structure of the carpus in *Dissacus* and *Mesonyx*, the displacement of the metacarpus upon the carpus in *Dissacus*, and also the articulation between the astragalus and cuboid in the latter.

An undiscovered species of *Pachyæna*, closely related to the *P. ossifraga*, but with the last upper molar more reduced than in that species, formed the transition stage between *Dissacus* and *Mesonyx*.

Family PROVIVERRIDÆ *Schlosser.*

Leptictidæ Cope, in part.

Genus **Deltatherium** *Cope.*

Dentition: $I\frac{3}{3}$, $C\frac{1}{1}$, $P\frac{3}{3}$, $M\frac{3}{3}$. Superior molars with external cusps removed inwards from the external cingulum. No intermediate tubercles. Protocone large and V-shaped. A postero-external trenchant surface extending from the metacone. Last inferior premolar nearly molariform in structure; true molars with trigonid high and trenchant. Inferior diastema large.

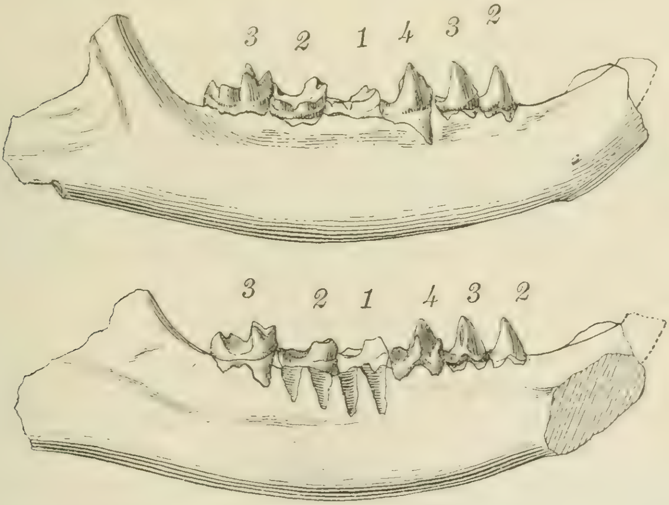


Fig. 10. *Deltatherium fundaminis.* Right lower jaw, external and internal view. Natural size.

Deltatherium fundaminis *Cope.*

This is one of the most abundant types in the Puerco, and is represented in the collection by a number of examples, the best preserved being Nos. 780, 781 and 783. It is very instructive in showing how specialized some of the Puerco Creodonts were. In fact, the high differentiation of the carnivorous mammals of this formation is surprising. *D. fundaminis* has already lost the first premolar in both jaws, and anterior to the second in the lower jaw there is a long diastema. The character of the true molars, and especially the trenchant form of the lower molars, is very different from that seen in most of the Creodonts of the Puerco.

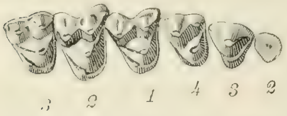


Fig. 11. *Deltatherium fundaminis.* Superior molars, crown view. Natural size.

Cope's material of *Deltatherium* is so well preserved that we are unable to add anything to his full description of this species. *Deltatherium* is closely related to the Wahsatch genus *Sinopa* (= *Stypolophus*), but is in some respects rather more specialized than that genus.

4. Order TILLODONTA.

The relationships of the heterogeneous members of this order require careful consideration which we have not yet been able to give. Cope places *Onychodectes* and *Conoryctes* with the Creodonta, but they show unmistakable affinities with *Esthonyx* and *Tillotherium.*

Genus **Onychodectes** *Cope.*

Onychodectes tissonensis *Cope.*

The collection contains a well-preserved skull and lower jaw (No. 785) of this species in which the teeth are badly worn. Another specimen (No. 786) consists of a part of the lower jaw containing the roots of all the premolars and the first two true molars.

This skull is of great importance, as it is the most complete one ever found of this type in the Puerco. The teeth agree precisely in size with the type upper molars of *O. tissonensis* Cope.

The skull is about as large as that of a small *Didelphys*. It is much lengthened between the glenoid facet and the last molar. The cranium is long and narrow, and there is no depression between the cranial and facial portions. There is a very faintly developed sagittal crest, which extends as far forwards as the posterior boundary of the orbit. The nasals are narrow and elongate, and the anterior nares are terminal in position. The palate is long and narrow, and the palatines and pterygoids form very narrow posterior nares quite different from that of the Lemuroidea.

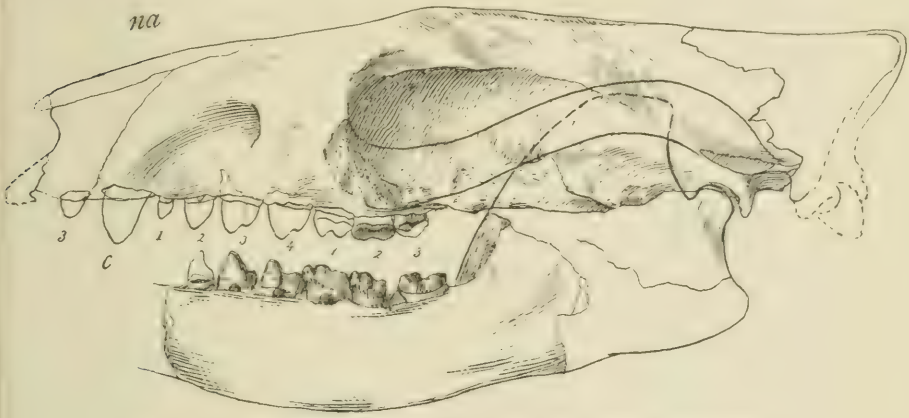


Fig. 12. *Onychodectes tissonensis.* Skull and lower jaw, side view. Natural size.

The upper teeth are mostly broken off. The fangs of the anterior teeth indicate that there is a well-developed incisor shortly in front of the canine; the latter tooth is laterally compressed, and the first premolar is small and single-rooted. The second and third premolars are double-rooted; the fourth premolar is three-rooted. It is evidently nearly as large as the molars. There is no preglenoid ridge. The angular region of the lower jaw is partly preserved, showing that the condyle is obliquely transverse; the coronoid is rather broad and the posterior border of the angle extends backwards. The inferior premolars are not spaced, and the posterior members of this series are robust. These have, however, been described and figured by Professor Cope.

Onychodectes rarus, sp. nov.

A prominent external cusp on each lower true molar, placed between the outer lobes.

This new species is established upon a jaw fragment which contains two of the lower true molars (No. 824). The most striking character is the very prominent cusp which is placed upon the external side just in front of the posterior lobe. The trigonid is well raised above the talonid. The paraconid is well developed; the protoconid is relatively robust and placed at the apex of the triangle and at an equal distance between the para- and metaconids. The talonid is broad and deep and extends into a basin on the inner side. The external interlobular cusp of the second molar is smaller than that of the first; it arises from the base of the hypoconid, and is placed just opposite the convexity of the latter.

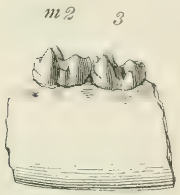


Fig. 13. *Onychodectes rarus.* Fragment of lower jaw with two true molars, external view. Natural size.

Measurements.

	M
Length of two lower true molars....	.015
Depth of jaw......................	.013

Psittacotherium multifragum *Cope.*

The division of the Tillodonta to which this species belongs is represented by a number of specimens, the best example of which is a nearly complete lower jaw (No. 754) associated with fragments of the skull, and with a number of teeth. Two much-worn premolar teeth are in place. As Cope has shown, the homologies of the lower cutting teeth are doubtful.

The alveoli correspond with the formula given by Cope, $I\frac{2}{2}$, $C\frac{1}{1}$, $P\frac{3}{3}$, $M\frac{3}{3}$.

The portions of the skull preserved correspond somewhat with those figured by Cope of *Hemiganus*. They represent the top of the cranium and the upper and anterior border of the orbit. The cranium is compressed above, but like *Onychodectes*, has no distinct crest; the indications are that it was very long and narrow with an extremely small brain; anteriorly the lambdoidal crests diverge very gradually instead of sharply, as in *Hemiganus*. They are very heavy and obtuse. There is no post-orbital process, and quite close in front of the orbit we observe as an exceptional feature a double infraorbital foramen.

Other specimens related to these types are Nos. 755, 756, 757, consisting mainly of fragments of teeth and of bones.

5. Order AMBLYPODA *Cope.*

This order of Ungulates includes the three suborders: Taligrada (Cope) of the Puerco; Coryphodonta (Marsh) of the Wahsatch; Dinocerata (Marsh) of the Bridger.

Suborder TALIGRADA *Cope.*

Primitive Amblypoda. Superior molars triangular, with selenoid cusps. Plantigrade. Astragalus with a distinct neck supporting navicular facet. A tibiale.

Family PANTOLAMBDIDÆ *Cope.*

Genus **Pantolambda** *Cope.*

Dentition: $I\frac{3}{3}$, $C\frac{1}{1}$, $P\frac{4}{4}$, $M\frac{3}{3}$. First upper premolar one-rooted; second, third and fourth three-rooted, with internal cones. Canines laterally compressed.

Pantolambda bathmodon *Cope.*

No diastema in the dental series.

These very primitive members of the Amblypoda are distinguished by the following characters, as observed in an unusually perfect skull (No. 964) in this collection. The dental formula is typical; the peculiar features of the superior molars are that although they present a broad transverse triangle, the apices of the three primary cusps (protocone, paracone and metacone) are brought close together as in the *Periptychus*, while the outer wall is very broad, exhibiting a parastyle and a metastyle, both well developed, while the mesostyle is feeble; the intermediate conules are also feebly developed or absent. The third superior molar exhibits a very large parastyle, making the outer border asymmetrical and foreshadowing the oblique development of the outer wall of this tooth in *Coryphodon*. The first upper premolar is single-rooted, while the second, third and fourth each have three roots; and, although the crowns are wanting, this demonstrates the presence of a strong internal cone. The fourth premolar exhibits a single deeply crescentic external cusp (protocone) and a strong crescentic internal cone (deuterocone) with feebly marked conules. The canines are directed outwards and laterally compressed. The dental series is continuous, as in the type of this species, while in the larger species, *P. cavirictus*, there is a considerable diastema behind the canines.

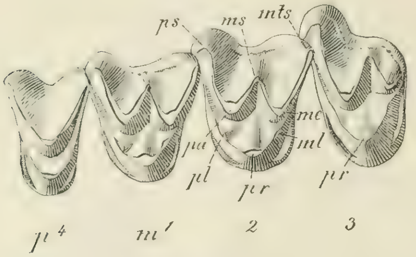
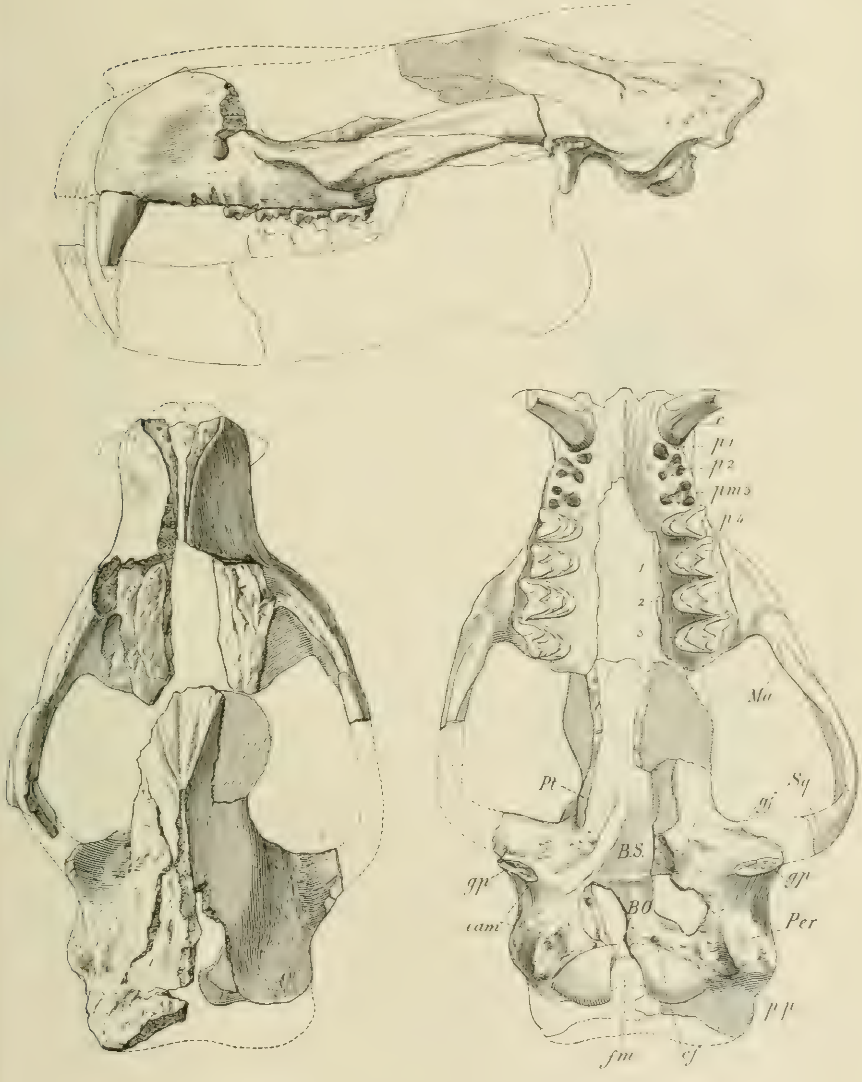


Fig. 14. *Pantolambda bathmodon.* Crown view of superior molars. Natural size.

The skull is of a very ancient type, exhibiting the following primitive characters: The anterior nares are terminal in position; the front border of the maxilla descends vertically, and the premaxilla, which is broken away in these specimens, was apparently short. The cranium is twice as long as the face; the brain-case proper is low and broad transversely; it is surmounted by a sharp sagittal crest and flanked posteriorly by lateral occipital crests; the occiput is, therefore, very broad and low, as in *Periptychus*, in lateral view. We observe that the zygomatic arches are very slender, and there is a wide space between the postglenoid process and the posttympanic. The posttympanic and paramastoid processes are confluent and very sessile. The basal view of


i
c
p1
p2
pm3
p4
1
2
3
Ma
Pt
Sq
gf
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gp
gp
BO
cam
Per
pp
fm
cf

Fig. 15. *Pantolambda bathmodon.* Skull: lateral, dorsal and ventral view. One-third natural size.

the skull shows that the pterygoids are extended very far back. The postglenoid processes are very small ; in fact, this view brings out well the simple and undifferentiated character of the base of the skull.

The posterior border of the lower jaw descends vertically behind the condyle, as seen in specimen No. 962, which probably belongs to this species. The scapula (No. 964) exhibits a shallow glenoid cavity, close above which is the base of the spine; the neck, therefore, is extremely short ; there is a long coracoid process recurved distally.

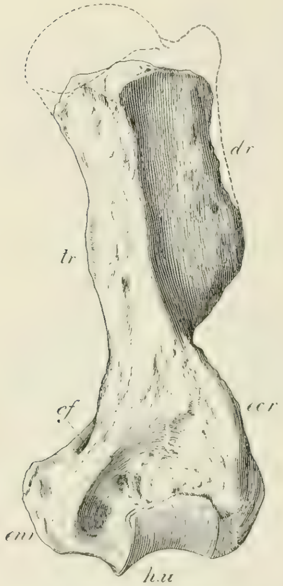

Fig. 16. *Pantolambda bathmodon.* Left humerus, posterior view. One-third natural size.

The humerus is massive ; it is characterized by a very large and prominent deltoid crest, which extends below the middle of the shaft ; on the inner surface of the shaft is a slightly prominent crest for the flexor muscles ; there is a large entepicondyle perforated by a foramen, and upon the outer side of the distal extremity there is an acute ridge which we observe is not developed in *Periptychus* ; distally the humeral condyles do not display any intertrochlear ridge. The ulna is placed entirely behind the radius ; its proximal section is deep anteriorly ; posteriorly the radius is preserved, but is so much damaged that its characters cannot be made out.

6. Order CONDYLARTHRA *Cope.*

Dentition bunodont. Manus and pes pentadactyl. Elements of carpus and tarsus serially arranged. Humerus with an entepicondylar foramen. Femur with a third trochanter.

The suborder Condylarthra was established by Cope[1] to include the genus *Phenacodus*. At that time he considered this genus to be a Perissodactyle, and placed the Perissodactyle group as an order, including the suborders Diplarthra and Condylarthra. Later[2] he proposed the order Taxeopoda, to include the Proboscidea and Condylarthra, but in his paper 'On the Classification of the Ungulate Mammalia,'[3] removed the Proboscidea from the Taxeopoda and gave it an ordinal position ; in the same paper Cope included under the Taxeopoda the suborders Condylarthra and Hyracoidea.

DOUBTFUL POSITION OF THE PERIPTYCHIDÆ.

In the present state of our knowledge it is difficult to say what forms should be included in the Condylarthra. If we adhere strictly to the diagnosis of this group laid down by Cope, we should have to omit the Periptychidæ from this suborder, because in the genus *Periptychus the tarsus is not serial;* there is a displacement of the astragalus upon the cuboid, and the whole structure and angulation of the hind foot is different from that of the type genus *Phenacodus*. *Periptychus* is quite as closely related in its pes to the Amblypoda as to the Condylarthra. *Periptychus* has the simple bunodont dentition of the Condylarthra, but it has the strictly trigonal molar of the Amblypoda.

The most specialized family of Cope's Condylarthra is the Meniscotheriidæ. Osborn[4] has shown that this is analogous to *Chalicotherium* in Cope's Ancylopoda. It thus appears possible that the Periptychidæ and Meniscotheriidæ must ultimately be removed from the Condylarthra, and that the Condylarthra may ultimately include only the stem forms of the Artiodactyla and the Perissodactyla.

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[1] Am. Nat., 1881, p. 1018.
[2] Am. Nat., June, 1882.
[3] Proc. Am. Phil. Soc., 1882, p. 438.
[4] Am. Nat., 1892, p. 507.

At present we enlarge the order by adding to it certain forms which Cope has placed among the Creodonta; we thus transfer the genus *Mioclænus* and family Mioclænidæ. We agree with Schlosser and Scott that the structure of the teeth in this genus shows it to be more closely related to primitive Ungulates than to any of the Creodonts.

The following table will illustrate the arrangement and subdivisions of the Condylarthra proposed in this paper.

Family MIOCLÆNIDÆ, fam. nov.

Genus **Mioclænus** *Cope.*

Dentition : ?I, C$\frac{1}{1}$, P$\frac{?}{4}$, M$\frac{3}{3}$. Third and fourth superior premolars with single internal cones. Superior true molars tritubercular, with hypocone very rudimentary. Last upper and lower molars reduced. Inferior premolars much enlarged and very simple in structure. Inferior true molars without paraconid.

The genus *Mioclænus* was established by Cope,[1] the type species being *M. turgidus.* At the time of the description of this genus Cope considered it closely related to *Euprotogonia* (=*Protogonia*) and in his divisions[2] of the Condylarthra in 1881 placed *Mioclænus* in the family Phenacodontidæ. Later[3] he omitted this genus from the latter family, saying: "I believe it to be Artiodactyle."

Upon the discovery of the structure of the skeleton of *Mioclænus ferox* Cope associated this species with *M. turgidus*, and referred both species to the Creodonta. The *M. ferox* has since been raised to generic rank by Scott as the type of *Clænodon.*

Cope in his 'Tertiary Vertebrata,' and later in his 'Synopsis of the Puerco Series,' included a great many other species under the genus *Mioclænus*, but Scott[4] in his paper 'A Revision of the

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[1] Proc. Am. Phil. Soc., Sept. 17, 1881, p. 489.
[2] Am. Nat., 1881, p. 1018.
[3] Proc. Am. Phil. Soc., Dec. 16, 1881.
[4] Proc. Acad. Nat. Sci., Phil., 1892, p. 321.

CONDYLARTHRA.

A.—With bunodont upper and lower molars.			*B.*—With buno-selenodont upper, and lopho-selenodont lower molars.
1. *Mioclænidæ.*	2. *Periptychidæ.*	3. *Phenacodontidæ.*	4. *Meniscotheriidæ.*
Molars and premolars similar to the *Periptychidæ* in plan. Molars lacking supplementary internal cusps; premolars lacking heels. Skeleton unknown.	Primitive triangle compressed in superior molars. Molars with triangular symmetry, never quadrate. Supplementary internal cingules (protostyle and hypocone). Third and fourth upper and lower molars enlarged. Inferior premolars with heels. Ulna upon anterior face of humeral trochlea. Astragalus flat, perforated.	Primitive triangle broad. Upper molars quadrate. Transformation of premolars as in Perissodactyla. Ulna only upon posterior face of humerus. Astragalus grooved, imperforate. No fibulo-calcaneal facet. Manus and pes digitigrade.	Primitive triangle broad. Upper molars with external crescents and internal tubercles. Lower molars crested. Transformation of premolars as in Perissodactyla. Astragalus perforated. A fibulo-calcaneal facet. Pes semi-plantigrade.

Creodonta,' has removed many of the species to a distinct generic position. He says of *Mioclænus:* " The name *Mioclænus* should be restricted to those forms which agree with the type species *M. turgidus* in the extremely broad, low and massive premolars, which equal or exceed the molars in size," etc.; and later remarks, " If, as Schlosser has suggested, it becomes necessary to refer *Mioclænus* to that group [Condylarthra], it will form a very distinct family of that order."

Mioclænus turgidus *Cope.*

First superior true molar with a rudiment of a hypocone. Last superior and inferior true molars reduced in size. Inferior true molars without a postero-internal cone (entoconid). First inferior premolar spaced.

There are numerous fragmentary specimens (Nos. 921–936, 938, 939) of this species in the collection, the best preserved being Nos. 930, 921, 922, 933. These specimens together illustrate the structure of the greater part of the dental series. Associated with No. 921 are fragments of the skeleton, especially a well-preserved sacrum.

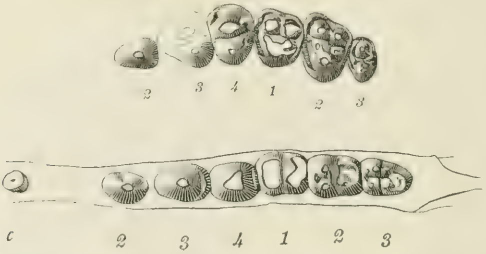

Fig. 17. *Mioclænus turgidus.* Superior and inferior molars. Crown view. Natural size. (No. 921.)

Dentition.—The second superior premolar consists of a single cone, without heels. The third and fourth have well-developed internal cones, which are single. These teeth have no intermediate tubercles. In the specimen under description (No. 921) there is a large diastema in front of the first superior premolar, but whether this interval is natural or not remains to be determined from better material. The superior true molars are very primitive in their characters, more so than in any of the known

Condylarthra ; the first molar presents rudiments of the parastyle and mesostyle on the outer wall ; the molars have well-developed intermediate tubercles, and only on the first is there a trace of a hypocone. The third true molar is much reduced in size, and the second is larger than the first. The reduction of M3 is against the Condylarth affinities.

The shape of the inferior premolars is highly characteristic; the first is not preserved, although an impression of its crown is left on the specimen ; it was simple in structure and isolated from the small canine in front, and also from the second premolar behind. The second, third and fourth premolars have much enlarged and swollen crowns, with only slight indications of posterior heels and with no trace of a deuteroconid ; the third and fourth present rudimentary anterior and posterior basal cusps. The inferior true molars closely resemble those of *Euprotogonia* ;[1] the crowns are very low, broad ; and the trigonid is somewhat raised above the talonid. In Cope's description of the dentition of *M. turgidus* he describes a trace of a paraconid on the first and second molars. In the American Museum specimens of this species the second true molar has a trace of a paraconid, and this tooth, as well as the third molar, exhibits no entoconid.

The sacrum is broad and short, its antero-posterior and transverse diameters being about equal. In its general characters it closely resembles that of *Oreodon.* The neural spine and prezygapophyses are low. In contrast with the sacrum of the Carnivora we notice the position of the sacro-iliac attachment ; it is elongated, narrow and parallel with the antero-posterior axis of the sacrum. The surface for articulation with the ilium is confined to the transverse process of the first sacral vertebra, as in the Ungulata in general.

Systematic Position of Mioclænus.

The most striking character of the dentition of *Mioclænus turgidus* which points to its relationship to the Periptychidæ is the enlargement of the lower premolars. The absolutely tritubercular superior molars, without a hypocone, except on M1, prove this form to be the simplest and most primitive type in its tooth structure of any of the known Condylarthra. A specialization in this genus—a character not anticipated in so old a type—is the probable presence of a *diastema* in the dentition ; this is an unusual character for any Puerco Ungulate to exhibit. One of the Creodonta (*Deltatherium*) of this formation is also quite specialized in this respect.

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[1] Am. Nat., April, 1893.

The discovery of fragments of the skeleton of *Mioclænus turgidus* is of great importance, and a well-preserved sacrum, already described, adds much weight to the theory of the ungulate affinity of this genus.

M. Pavlow[1] has suggested that *M. turgidus* is an intermediate form between *Periptychus rhabdodon* and *Anisonchus sectorius.* It appears rather that *Mioclænus* is much more primitive in its dental characters than *Periptychus*, and should be placed below that genus structurally. As *M. turgidus* is rather an unspecialized type in its dentition, it is possible that it may have been one of the few types of the Puerco which persisted in later periods, and Earle[2] has suggested elsewhere that this genus may stand in ancestral relationship to some of the White River bunodont Artiodactyles, such as *Leptochœrus.*

Family PERIPTYCHIDÆ *Cope.*

It is convenient to divide this into two subfamilies : 1. *Anisonchinæ*, to include the smaller and more primitive forms ; 2. *Periptychinæ*, to include the larger and more specialized forms.

1. *Anisonchinæ.*	2. *Periptychinæ.*
Smaller forms. Superior molars with intermediate tubercles (conules) suppressed or wanting. Inferior molars with paraconid reduced or wanting. ? Astragalus with elongate neck.	Larger forms. Superior molars with conules well developed. Inferior molars with paraconid well developed. Astragalus with a short neck.

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[1] Études sur l'Histoire palæontologique des Ungulés, Bull. de la Société Imp. des Naturalistes de Moscou, 1887. p. 19.

[2] Science, July 28, 1893, p. 51.

Subfamily PERIPTYCHINÆ.

Genus **Periptychus** *Cope.*

Dentition: $I\frac{3}{3}$, $C\frac{1}{1}$, $P\frac{4}{4}$, $M\frac{3}{3}$. Teeth vertically sculptured. Protocone of superior premolars much elongated and recurved. Last three superior premolars with crescentoid internal lobes. Superior true molars with supplementary internal cusps well developed. Inferior true molars with paraconid.

Periptychus rhabdodon *Cope.*

Superior true molars as broad as long, and provided with two intermediate tubercles; third not reduced in size. Superior premolars much enlarged, and with internal cusps uniting into a continuous internal crescent. All the teeth strongly sculptured.

A large number of specimens (Nos. 854–878) represent this species in the collection. The dentition of *P. rhabdodon* has been fully described by Cope.

The best example of part of a skeleton in the collection is a hind limb with a well-preserved calcaneum and astragalus (No. 837). The *femur* is short and rather stout, the third trochanter is placed slightly above the middle of the shaft. The crest of the *tibia* is very prominent and extends far down upon the shaft; the distal articular end of the tibia faces obliquely outwards, and is nearly plane; there is a slight ridge dividing the internal from the external trochlea; the internal malleolus is very prominent and peculiar in form; it is strongly grooved for a flexor tendon.

The *fibula* is well preserved; it is a short and heavy bone. The proximal extremity is flattened and expanded, and it exhibits a concave facet for articulation with the tibia; externally this end has a prominent rugose process; the shaft at its middle part is oval in section, and its anterior face is separated longitudinally by a ridge; the distal extremity is much enlarged and presents a very plane (articular) surface for the astragalus; the external malleolar tuberosity is strongly marked, and is nearly as prominent as in the Bear. As compared with that of *Ursus*, the fibula of *P. rhabdodon*, in contrast with the size of the tibia, is much larger, and its shaft is thicker.

There are two astragali of *P. rhabdodon* in the collection, and in both there is a plainly marked *astragalar foramen* ; this aperture is situated well toward the median trochlear surface, and commences just at the posterior limit of the articular face. The presence of this foramen in *Periptychus* is a constant character, and in this respect it differs much from the genus *Coryphodon*, in which it is variable ; in both these genera the foramen has the same position, namely, between the ectal and sustentacular facets. We doubt whether it transmitted a flexor tendon, as it is not clear how a tendon could traverse this foramen and then pass outwards under the sustentaculum ; it is more likely that this foramen transmitted a blood vessel or a nerve. We are not aware that it exists in any recent Ungulate, yet it is a constant character of all Puerco forms, and a vestige of it has been observed by Wortman in the pinniped Carnivora.

Measurements of bones of Hind Limb.

	M.
Length of femur	.163
Width of same proximally	.046
Length of tibia	.140
Breadth distally	.027
Length of fibula	.124
Breadth distally	.016
Total length of limb, allowing for ankle flexure,	.280

Periptychus coarctatus *Cope.*

Internal cingulum of inferior premolars discontinuous. Superior premolars with great transverse extent. Intermediate tubercles present on true molars. Superior and inferior true molars with external cingulum.

The *P. coarctatus* is represented in the American Museum collection by the greater part of the upper and lower dentition of one individual (No. 850). This species is a decidedly smaller type than *P. rhabdodon*. The upper true molars are nearly the size of those of *P. brabensis*, but their transverse diameter is greater ; the inferior premolars on the other hand, are relatively enlarged in *P. coarctatus*.

Dentition.—The last superior premolar has a greater transverse extent than the first true molar ; yet the superior true molars are also much extended transversely, their external cones are small and considerably raised above the surface of the teeth. The intermediate tubercles are well developed in this species, and the last true molar as compared with the first and second is relatively much smaller than in *P. rhabdodon.* The inferior premolars are smaller than those of *P. rhabdodon*, in which the anterior and posterior tubercles are weakly developed. The first upper true molar is larger than the others, and its protoconule is more robust than in the allied species. The last lower molar is small, and the three cusps of the talon are more distinct than in *P. rhabdodon.*

Measurements of teeth of P. coarctatus.

	M.
Length of last four upper molars	.032
Length of superior true molars	.022
Length of inferior premolars	.040
Length of inferior true molars	.028

Periptychus brabensis *Cope.*

Cingula of inferior premolars discontinuous. Transverse diameter of superior premolars less than that of true molars. Superior and inferior true molars with external cingula reduced or wanting; intermediate tubercles of superior true molars wanting.

There is only one specimen of this species in the American Museum collection (No. 849). This contains the greater part of the lower dentition and some of the upper molars.

The external face of the molars in both jaws is only slightly sculptured. The first superior molar is triangular in outline, with protocone smaller than in the second. The second *superior molar* is well preserved, and is of a square form; as compared with other species this tooth is considerably modified; the protocone, instead of being a simple tubercle, as in the *P. brabensis*, is a crescent, and the intermediate tubercles are fused with its anterior and posterior spurs; both the internal supplementary cusps are relatively more developed than in the large *P. rhabdodon.* The last superior molar is not reduced in size as in the *P. coarctatus.* The transverse diameters of the last upper premolar and first true molar are about equal.

The last two *inferior premolars* are much elongated antero-posteriorly, with a small transverse diameter; the anterior and posterior heels are prominent but not continuous internally. The second *inferior molar* is smaller than the first, and in this respect the *P. brabensis* differs from the *P. rhabdodon ;* the paraconids of the lower molars are not so distinct as in the last-named species. A single *incisor* is preserved with this specimen, which probably belongs to the lower series ; the crown is strongly compressed, with a slightly *enlarged* posterior heel.

Genus **Ectoconus** *Cope.*

Dentition : $I\frac{3}{3}$, $C\frac{1}{1}$, $P\frac{4}{4}$, $M\frac{3}{3}$. Last three superior premolars with internal crescents ; third and fourth sub-molariform. Superior molars consisting of seven cusps and two external cingular cusps. Last inferior premolar with cusps of trigonid well developed. Inferior molars sextubercular, with an antero-internal accessory cusp ; internal to paraconid.

Ectoconus ditrigonus *Cope.*

Superior and inferior true molars with a strong external cingulum. Last superior molar nearly as large as first. Postero-external cingular cusp of superior true molars opposite metacone.

This species was first referred by Prof. Cope[1] to *Conoryctes*, but was later[2] established as the type of *Ectoconus*. The dentition (Nos. 880–888) has been only partially described by Cope, and our abundant material enables us to complete his account. The superior incisors are of a simple conical form, and increase in size from within outwards ; their position is peculiar, as they are separated by an interval from each other. The finest specimen of *Ectoconus* in the collection is No. 880 ; in this both upper and lower teeth are from the same individuual ; the upper canine was large, as is shown by the basal part of the crown, which is preserved ; the single alveolus for the first superior premolar is intact, and this tooth probably had a simple crown ; it is slightly separated from the canine and the premolar succeeding it.

The *premolars* of *E. ditrigonus* differ very much in their pattern from those of *Periptychus*. The last three superior premolars have one external cone, and this is not elongated or sculptured ; the internal lobes of these teeth are crescentoid, and in the last two of the series they early unite by wear with the two intermediate tubercles, thus presenting a crescentoid tract of worn enamel. The last upper premolar is a much smaller tooth than the first true molar. A marked characteristic of this genus is that the third and fourth premolars remotely repeat the molar pattern, whereas in *Periptychus* they are wholly dissimilar.

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[1] Am. Nat., 1883, p. 968.
[2] Am. Nat., 1884, p. 796.

The *molars* are rectangular in form and are much drawn out transversely ; they therefore differ in shape decidedly from those of the allied genus *Periptychus*. The large number of cusps is the most distinctive character. In strong contrast to other Puerco Ungulates, the upper molars of *Ectoconus* have an external cingular cusp placed just outside of the metacone, and whether it is homologous with the median (mesostyle) or the posterior cingular cusp (metastyle) of higher forms, it is difficult to say. In some examples of this species there are two cingular cusps on the second superior molar, one behind the other. The protocone of the molars is large and soon unites by wear with the intermediate tubercles ; these conules are larger than in *Periptychus*, especially the protoconule. The two internal supplementary cusps (protostyle and hypocone) are well developed, and arise from larger cingula than in *Periptychus*. The last superior molar of *E. ditrigonus* is nearly as large as the second, and is provided with two well-developed external cones ; the paracone is connected with the external cingulum by an oblique ridge. In all the superior molars of this species the antero-external part of the basal cingulum is prominent, and on the last upper molar forms a very distinct cusp.

The inferior molars are much crowded together, and there is no diastema between the canine and the first premolar (No. 880) ; this tooth is absent in the specimen under description, but represented by a small alveolus placed close to the second premolar. In Cope's specimen of *E. ditrigonus* the second inferior premolar has a small internal cusp ; on the third premolar this cusp is also present, and the two cusps of the talon are fully developed. The last inferior premolar (see No. 890) is quite complex in structure for so early a type ; it exhibits the three principal cusps of the trigonid, but the postero-internal cusp is absent. The complex sub-molariform structure of the posterior and lower premolars in

Ectoconus is to be noted in contrast with *Periptychus.* In No. 890 the fourth premolar is very similar to the first molar. The inferior true molars are broad, with a low and indifferent arrangement of the cusps; the protoconid is on a line with the paraconid, and not placed opposite the interval between the two internal cusps as in *Periptychus.* The specimen, No. 880, in the collection exhibits a well-marked cusp on the second and third inferior true molars just within the paraconid; this cusp is not present in *Periptychus.* The last lower molar is considerably extended antero-posteriorly, and the hypoconid is placed far forward like that of *Periptychus.* The hypoconulid is very large on this tooth, much larger even than the entoconid.

Measurements of Teeth of Ectoconus.

	M.
Total length of superior molars	.062
Length of superior premolars	.033
Length of superior true molars	.029
Total length of inferior molars	.064
Length of inferior premolars	.030
Length of inferior molars	.034

Humerus.—Near the upper and lower jaws (No. 888) was found a large humerus from the left side, which may belong to this species, although the association is somewhat doubtful. It measures slightly over 150 mm. in length. It is robust, with much more prominent crests for the deltoid and supinator muscles than are seen in *Periptychus.* The latter or ectepicondylar ridge is exceptionally prominent and is carried over upon the front face of the shaft as in fossorial animals, and differing from both *Periptychus* and *Pantolambda.*

Subfamily ANISONCHINÆ.

Genus **Haploconus** *Cope.*

Dentition: $I\frac{1}{1}$, $P\frac{4}{4}$, $M\frac{3}{3}$. Fourth superior premolar only with an internal cone. Superior molars with protocone crescentoid in form; no distinct intermediate tubercles; no anterior supplementary cusps (protostyle). Last three inferior premolars with heels; no internal cusps. Inferior molars without paraconid.

The genus *Haploconus* is readily distinguished from the three others of this subfamily: (1) By the absence of a deuterocone on the third superior premolars; (2) the development of the hypocone is less advanced than in the genus *Anisonchus*, but more so than in *Hemithlæus;* (3) the inferior premolars of *Haploconus* are elongated, whereas in *Hemithlæus* (*H. apiculatus*) they are considerably enlarged, more resembling those of *Mioclænus.*

Haploconus lineatus *Cope.*

Fourth superior premolar enlarged; fourth superior premolar spaced with internal cone crescentoid. Hypocone of superior molars larger than anterior supplementary cusp (protostyle). Third and fourth inferior premolars somewhat elongated and trenchant.

The characters of the lower premolars in this species are closely related to those of *Anisonchus mandibularis*, although Cope states that in the last-named species the third superior premolar has an internal lobe, which places it in *Anisonchus.*

The best specimen (No. 891) in the collection of *H. lineatus* is a set of superior molars, associated with the fragmentary remains of a part of a skeleton. The structure of the skeleton in *Haploconus* has been until the present time totally unknown, and we are happy to be able to give some information as to it. Many broken fragments of the long bones are associated; they are long and slender, and their general proportions are as in the limbs of *Lemur varius.* A distal extremity of a humerus exhibits a well-marked entepicondylar foramen. A proximal part of an ulna exhibits an olecranon process which is long, slender and strongly compressed; the coronoid process is short and does not extend as far forward as in Ungulates; the two divisions of the sigmoid cavity are unequal in size as in the Carnivora, and lastly, the ulno-radial facet is small and limited to one side as in the Carnivora. The most interesting bones are, however, part of a calcaneum and an astragalus. The proximal portion of the *calcaneum* is high and narrow, the ectal facet is raised high above the sustentaculum; this latter facet is round and oblique in position. The *astragalus* differs widely in its characters from that of *Periptychus;* the trochlear surface is nearly plane, there being only a slight median depression ; a large astragalar foramen perforates this bone at the posterior limit of the articular surface ; unfortunately the navicular facet is missing, but enough remains of the base of the neck to show that the latter was slender and elongated, in marked contrast with the short neck in *Periptychus.*

We conclude from these characters of the skeleton that *Haploconus lineatus* was an exceedingly slender type, with elongated limbs, probably adapted for an arboreal life. These characters are also radically different from those of the heavy-limbed plantigrade *Periptychus*, which has hitherto been supposed to be closely related to *Haploconus* when judged by the teeth alone.

Genus **Hemithlæus** *Cope.*

Dentition : $C\frac{1}{1}$, $P\frac{4}{4}$, $M\frac{3}{3}$. Third and fourth superior premolars with single internal cones; protocones of superior molars crescentoid ; supplementary cusps (protostyle and hypocone) of equal size. Inferior premolars with enlarged protoconids; deuteroconid variable. Paraconid reduced in molars.

Hemithlæus kowalevskianus *Cope.*

Anterior and posterior cingula of upper molars slightly produced into supplementary internal cusps ; third upper molar much reduced in size. Third and fourth inferior premolars conic and not larger antero-posteriorly than true molars, and without anterior tubercles; heels small.

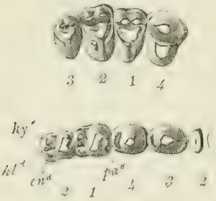

Fig. 18. *Hemithlæus kowalevskianus.* Crown view of superior and inferior molars. Natural size.

This species is represented in the collection by a fine set of upper and lower true molars, with part of the premolar series (No. 900). This species is smaller than *H. apiculatus*, and its inferior premolars are simpler in structure and slightly enlarged, although less so than in *Mioclænus turgidus.*

Genus **Anisonchus** *Cope.*

Last two superior premolars with internal cones. Superior molars quadrate in form, with a large development of the hypocone. Inferior premolars much elongated antero-posteriorly, with the third longer than the last. Paraconids of inferior true molars present but reduced.

Anisonchus is the most highly developed member of the subfamily, and the superior molars of this genus are transitional in structure between the tritubercular and quadritubercular forms. The hypocone is largely developed and extends inwards beyond the protocone. The inner cones of the upper premolars are crescentoid in section. The structure of the superior true molars in *Anisonchus* is more advanced than in the allied genus *Hemithlæus*. We believe the latter generic name should be retained.

Anisonchus mandibularis *Cope.*

Third inferior premolar much elongated antero-posteriorly. Hypocone of superior molars more extended inwards than in *A. sectorius*.

A number of mandibuli represent this species in the collection (Nos. 893, 894, 895 and 896). It is uncertain whether the *A. mandibularis* is fully distinct from *A. sectorius*, as in both species the third inferior premolar is elongated. A mandible in the collection (No. 896) has the entire inferior dental series finely preserved; the canine is long and slender; it is convex externally and concave internally. The canine is separated by a diastema from the first premolar, which in turn is also some distance from the second. The first premolar is a very minute tooth, and is much smaller than the second.

The following specimens belonging to members of the Anisonchinæ have not yet been determined, owing to their fragmentary characters: Nos. 893, 897, 903, 904, 907, 917.

RELATIONSHIPS OF THE GENERA OF THE PERIPTYCHIDÆ.

The question of the relationship between the different genera of the Periptychidæ is a difficult one to decide. In most cases we know very little about the skeleton of these forms, and therefore must depend upon dental characters to establish their affinities.

Mioclænidæ.—As we have already attempted to show, we consider *Mioclænus turgidus* more closely related to the Periptychidæ than to any of the Creodonta. The characters of the teeth show it to be the most primitive member of the suborder. The superior true molars in *M. turgidus* are simpler in structure than in most of the genera of the Periptychidæ ; they are tritubercular without any internal supplementary cusps ; the external cones are low and conical, and the intermediate tubercles are well developed. The last two superior premolars have one internal and one external cone ; by the presence of an internal cone to superior Pm. 3, *M. turgidus* is more advanced in this single character than *Haploconus*, otherwise we must consider it to be a more primitive form than the latter genus. The lower premolars in *M. turgidus* are very simple in structure and much less complicated than those of *Haploconus*, approaching in their structure those of *Hemithlæus*. The inferior true molars of *Mioclænus* also remind us of *Euprotogonia*.

Anisonchinæ.—In this family there are ten or twelve distinct species, partly representing different lines of descent and partly different stages of evolution in the same line. It is evident that this evolution and divergence represents a long period of time, but unfortunately we have few data as to the vertical distribution of species.

Cope has unfortunately made the *successive addition of internal cones to the premolars* the sole basis of his generic definitions—by analogy with other groups this merely indicates *successive modification in time* of animals perhaps belonging to different phyla. The true key to the separation of the phyla is not this character chosen by Cope, but the *rounded or flattened form of the upper and lower premolars*. Taking this key, we discover two sharply defined series, as follows : Series A.—In which the lower premolars are flattened and develop anterior basal cusps, while the upper premolars exhibit *crescentic* internal cones. Series B.—In which the lower premolars are *rounded* and never develop anterior cusps, while the upper premolars exhibit *conic* internal cones. The natural inference is that these two series represent two distinct or divergent lines of descent, and that the parallel successive stages of modification in time are indicated by the gradual addition of secondary cusps upon the premolars and molars. A reclassification of Cope's species on this basis would greatly simplify our conceptions, but would introduce endless confusion in the nomenclature.

A. [Related to *Periptychus.*]			*B.* [Related to *Ectoconus.*]	
Premolars to which cusps are added.		Lower premolars flattened. Internal cusps of upper premolars crescentic.	Lower premolars rounded. Internal cusps of upper premolars conic.	Upper molars; number of internal cusps.
Upper.	Lower.			
P3–4	P2–4	Hemithlæus apiculatus; H. corniculatus.	H. kowalevskianus.	2
"	"	Anisonchus gillianus.		1
"	P3–4	" sectorius....	A. coniferus.	1
"	"	" mandibularis.		1
P4	P4	Haploconus xiphodon...	H. cophater. H. entoconus.	1
"	0	" lineatus.		

The vertical lines of species as here arranged do not imply phyletic descent, for it is noteworthy that the species of *Haploconus* (otherwise the most primitive) usually lack the paraconid in the lower molars, while the species of *Anisonchus* and *Hemithlæus* (otherwise more specialized) usually exhibit the paraconid, which is always to be considered a primitive mark. The table does illustrate the parallel transformation of species in different phyla both in the addition of internal cones to the premolars and of internal styles to the molars. The species of Series A are evidently most nearly related to the still more highly Periptychinæ, for *Hemithlæus apiculatus*, with the addition of an internal crescent to the second upper premolar, would closely resemble a miniature *Periptychus*. On the other hand, the species of Series B are related to *Ectoconus*. Thus, Series A represents one line, Series B a second line, and *Zetodon* a third.

Relationship of the Periptychidæ to other Groups.

It is probable that none of the known genera of the Periptychidæ, with the possible exception of *Mioclænus turgidus*, persisted into higher types. This is indicated in *Periptychus* by the peculiar specialization of its premolars, and if this genus is related to any Wahsatch group it is to the Amblypoda. We do not agree with Schlosser in deriving any of the Artiodactyla from the Anisonchinæ, which were already somewhat specialized in their structure, and were probably adapted for an arboreal life, representing in the differentiation of the Puerco fauna the small and agile climbers. As Earle[1] has shown elsewhere, it is probable that in the Puerco we have a stem form of the Artiodactyla in *Protogonodon*, a genus which was more closely related to *Euprotogonia* than to any of the Periptychidæ.

Family PHENACODONTIDÆ.

Genus **Euprotogonia** *Cope.*

Protogonia Cope.

Last superior premolar with only one well-developed external cone, tritocone rudimentary. Superior true molars sextubercular, and without parastyle or mesostyle. Last lower premolar with deuteroconid and paraconid; talon large. Inferior true molars generally quadritubercular, with hypoconulid.

Cope[2] has only recently substituted the name *Euprotogonia* for *Protogonia*. The type species is *E. subquadrata*;[3] this differs considerably in the structure of its upper molars from *E. puercensis*. Cope[4] in his revision of the species of *Euprotogonia* has omitted the type species. In the type species the section of the external cusps of the upper true molars is lenticular, and the hypocone is very rudimentary. We therefore consider the type form nearer to *Mioclænus* than to *Euprotogonia*.

The most common form of this genus from the Puerco is the *E. puercensis*, and it illustrates the characters of the teeth in this genus. The tritocone, or second external cusp, on the fourth superior premolar is variable, but in *E. puercensis* this cusp is small and well defined. The most important generic characters distinguishing *Euprotogonia* from *Phenacodus* are the conic form of the external and internal molar cusps, and the absence of the cingular cusps. The latter are always present in *Phenacodus*, but the species of this genus do not always exhibit both anterior and median cingular cusps. The last inferior premolars in *Euprotogonia* and *Phenacodus* are similar in structure; in the former the metaconid is less separate from the paraconid than in the latter.

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[1] Am. Nat., April, 1893, p. 377.
[2] Am. Nat., 1893, p. 378.
[3] Proc. Am. Phil. Soc., 1881, p. 492.
[4] Synopsis of the Vertebrata of the Puerco Series, Proc. Am. Phil. Soc., p. 359, 1888.

In *E. puercensis* the inferior true molars are quadritubercular, and there is no paraconid. In *E. plicifera* this cusp is present, as described by Cope. Comparing the development of the inferior crescents in *Euprotogonia* with *Phenacodus*, we observe that in the former genus they are fully as well marked as in the latter.

Euprotogonia puercensis *Cope.*

Last superior premolar with a small tritocone. Superior true molars with hypocone smaller than protocone. Inferior true molars lacking the paraconid.

This species is represented in the American Museum collection by a number of specimens (Nos. 940–947); the most perfectly preserved is No. 941, in which both upper and lower teeth are from the same individual.

Dentition.—As shown by Cope, the characters of the upper true molars of *E. puercensis* approach more closely those of *Phenacodus wortmani* than of *P. primævus*. It appears that if we confine ourselves to the premolars in separating *Euprotogonia* from *Phenacodus*, there are no distinct lines between the two; the case with the true molars is different. In *P. primævus* the external lobes of the superior molars are distinctly flattened, and there is a well-marked parastyle and mesostyle. The external lobes of the upper molars of *Phenacodus wortmani* are conical and closely resemble those of *E. puercensis*. The last inferior premolar in the latter is as complex as in *Phenacodus*, the two posterior cusps of the trigonid being equal in size, and the talon having the same structure. It is of importance phylogenetically to recognize the rather complex structure of this tooth in *Euprotogonia* as a Perissodactyl ancestral type, because in *Protogonodon*, a supposed Artiodactyl ancestor, the last inferior premolar is simple.

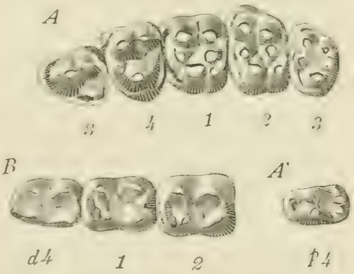

Fig. 19. *Euprotogonia puercensis*. *A*, Crown view of superior molars. *A* 1, Last inferior premolar, and *B* first two inferior true molars and last milk molar. *A* and *A* 1, are from the same individual. Natural size.

Affinities of Euprotogonia.

First: it is remarkable that the grinding teeth of *E. puercensis* agree precisely in size and in almost every detail of structure with those of *Hyracotherium vulpiceps* Owen,[1] from the London Clay. The latter is only a shade more modernized. This strongly confirms Schlosser's supposition that this species is a direct ancestor of the Equidæ. Second: it is significant that this genus is the only one known from the Puerco which has a well-developed sextubercular superior molar. In some of the Periptychidæ (*Anisonchus*) the hypocone is large, but the intermediate tubercles are absent. In *Euprotogonia* we have a form which, as far as our discoveries have progressed in reference to the Puerco fauna, may be considered ancestral to all the Wahsatch Condylarths and Perissodactyls. Dr. Schlosser[2] has gone further and singled this out as the *sole* ancestor in the Puerco of the true Equine line, but in such an early geological period it is not possible to determine whether *Euprotogonia* may not also have been the ancestor of the Phenacodontidæ.

We may suppose that the feet of *Euprotogonia* were semi-plantigrade and provided with five well-developed digits, the elements of the podium being serially arranged; while turning to the Wahsatch *Hyracotherium* we find quite a modernized arrangement of the podials, very different from that in *Phenacodus*. In *Hyracotherium* the first digit of the manus has disappeared, and the lunar has a broad articulation with the unciform, the scaphoid extending also on the magnum.

Unfortunately we know nothing of the skeleton in *Euprotogonia*, and must depend upon the characters of the teeth. Comparing the teeth of *Euprotogonia* with those of the Wahsatch successors, we find them, as is well known, much less specialized than in either of the Wahsatch Perissodactyla (*Hyracotherium*, *Systemodon*). In *Phenacodus*, as well as in *Euprotogonia*, the second superior premolar has a simple external lobe, while in *Hyracotherium* and *Systemodon*, especially the former, this tooth has two well-developed external lobes, and the third and fourth premolars are still more complex.

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[1] Proc. Geol. Soc., 1857, p. 54.

[2] Stammesgeschichte der Hufthiere (Morph.-Jahrb., Bd. xii, 1887, p. 11).

Genus **Protogonodon** *Scott.*

Mioclænus Cope, in part.

Superior true molars tritubercular without a hypocone. Both intermediate tubercles distinct, but tending to coalesce with protocone, forming an internal crescent. Last inferior premolar simple in structure, and showing only in some specimens an indication of a deuteroconid. Inferior true molars with trigonid not raised above talon, and with paraconid well marked. Lower jaw long and slender.

The genus *Protogonodon* was established by Prof. W. B. Scott,[1] to include the species of *Mioclænus* called by Cope *M. pentacus*. We consider the separation of this genus from the typical form of *Mioclænus*, viz., the *M. turgidus*, to be a decided advance in our knowledge of these early Eocene forms. Scott in his valuable paper 'A Revision of the Creodonta,' already referred to, places the genus *Protogonodon* among the Condylarthra, and says: "I think there can be no doubt that this genus is referable to the Phenacodontidæ." The discovery of a series of upper molars, which should probably be referred to *Protogonodon*, causes us to assign this genus a position nearer the line leading to Artiodactyla (*Trigonolestes*), than to that leading to the Perisodactyla and Condylarthra of the Wahsatch (*Euprotogonia*).

In a short notice in the 'Naturalist,' Earle[2] has given his reasons for placing *Protogonodon* as the probable condylarthrous ancestor in the Puerco of the Artiodactyla, and we believe it holds the same relationship to that group as *Euprotogonia* does to the Perissodactyla. We have temporarily included *Protogonodon* in the family Phenacodontidæ, but further knowledge of its structure will probably prove that it should be placed in a new family. The supposed upper molars of this genus are quite different in structure from those of *Euprotogonia*.

Protogonodon pentacus (*Cope*).

Mioclænus pentacus Cope.

Superior true molars with a strong external cingulum; internal cingulum complete on last superior molar; the latter as long transversely as the first. Inferior true molars with external cingulum. Hypoconulid of last lower molar small and not widely separated from entoconid.

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[1] Proc. Acad. Nat. Sci. Phila., 1892, p, 322.

[2] American Naturalist, 1893, p. 377.

Dentition.—The superior molars (No. 954), which we refer to this genus, were not found with the lower teeth, but their general character and size are exactly what we should expect to find in the upper molars of *Protogonodon.* The form of the superior molars in this genus is short and broad; the external cusps are very low and widely separated. The external lobes of the upper molars resemble somewhat those of the Creodonts (*Sarcothraustes*), but are much lower. There is a prominent external cingulum on all the molars, which extends completely across the external face of the teeth. The intermediate tubercles are strongly marked, and they have spurs which run outwards and join the anterior and posterior cingula respectively. The protocone is large and placed at the internal end of the median valley, and at an equal distance between the outer lobes. The protocone, like the intermediate tubercles, has crests running outwards from it, and when the teeth are much worn these elements of the crown unite, and as a result there is formed a well-marked internal crescent. The first superior molar is square in outline, with its internal cingulum incomplete; the second has the cingulum more developed than in the first, and in the third it is complete. In strong contrast to some of the other Puerco forms, the upper molars of *Protogonodon* can be said to be without hypocone; only on the first and second molars is there any rudiment of the hypocone upon the posterior cingu-

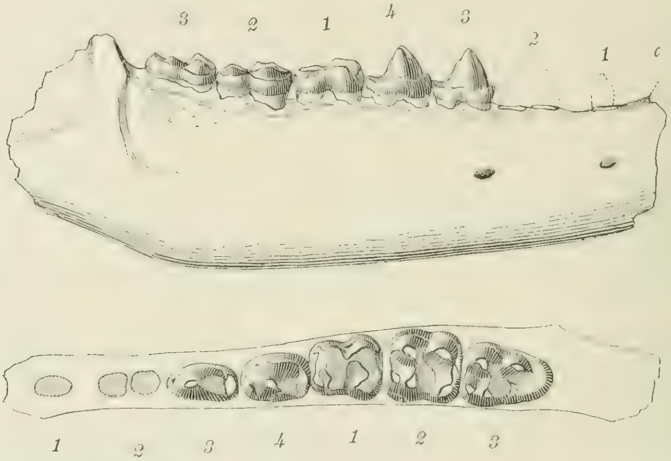

Fig. 20. *Protogonodon pentacus.* Left lower jaw. Superior and external view. Natural size.

lum. This character of the upper molars of this species is very different from most of the Periptychidæ, where the hypocone is generally well developed. The last upper true molar in *P. pentacus* is as long transversely as the first ; it has two well-marked external cones, and the intermediate tubercles are distinct. Comparing then the upper true molars of *Protogonodon* with other allied forms from the Puerco we find that its simple tritubercular molars and the want of supplementary internal cones, sharply differentiates this genus from the other Condylarthra.

We would suggest that the most similar form to *Protogonodon*, in the characters of the upper teeth, is the *Mioclænus turgidus*. In the latter genus the internal supplementary cusps of the upper true molars are wanting, or only feebly developed on the first molar. The first lower premolar in the *P. pentacus* is single rooted and separated by a short interval from the Pm. 2. The crowns of all the lower premolars are very simple in structure, and the last premolar of the type specimen is without a deuteroconid. Scott[1] has figured two specimens of the last inferior premolar in *Protogonodon* from Cope's collection, and in both of these teeth there is a minute deuteroconid. However, in comparison with *Euto-protogonia*, or any of the Periptychidæ, the last inferior premolar in *Protogonodon* is much simpler in structure.

If we compare this tooth with that of *Trigonolestes*, we observe a close resemblance in their general form and structure. The type specimen of *Protogonodon pentacus* agrees with that of *Pantolestes*, in the last inferior premolar lacking a deuteroconid. The presence of this cusp on the last inferior premolar is of general occurrence in all the Phenacodontidæ, and in one of the contemporaries of *Protogonodon*, viz., *Euprotogonia*, it is as large as the paraconid.

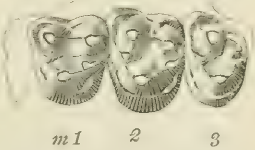

Fig. 21. *Protogonodon pentacus.* Superior true molars. Crown view. Natural size.

The inferior true molars in *Protogonodon* are low and broad (Nos. 951, 954) ; the trigonid is not raised above the talon, and a well-marked paraconid is present on all the molars. The external cusps of the lower molars are not so crescentoid in section as in *Trigonolestes ;* these cusps tend to unite very early with the metaconids. The anterior spur of the crescents is also less well developed than in *Trigonolestes.* The lower true molars in this genus resemble somewhat those of the Arctocyonidæ, but in this family the hypocone is generally present and the upper molars "are more or less completely quadritubercular."

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[1] 'Evolution of the Premolar Teeth in the Mammals.' Proc. Acad. Nat. Sci. Phila., 1892, p. 247.

The lower jaw in *P. pentacus* (No. 950) is much elongated and slender. The portion of the horizontal ramus below the true molar series is of the same depth throughout, but below the last premolar becomes more slender and decreases rapidly in depth towards the symphysis. We hold that the form of the mandible in *Protogonodon* is one of the strongest points in relating it to the Artiodactyla, and like the jaw in that group, more especially the selenodont Artiodactyla, the portion of the horizontal ramus behind the dental series rises abruptly upwards, leaving a deep concavity below. The jaw of *Trigonolestes* closely resembles that of *Protogonodon.*

RELATIONSHIP OF PROTOGONODON.

We now propose to review the characters of *Protogonodon* and give our reasons for assigning this genus a position in or near the line leading to the Artiodactyla.

1. The supposed superior true molars of *Protogonodon pentacus* are tritubercular, and without the internal supplementary cusps (protostyle and hypocone) so characteristic of the Periptychidæ. In this character *Protogonodon* agrees with the earliest known American Artiodactyle, viz., *Trigonolestes.*
2. The inferior premolars of *Protogonodon* are simple in structure, and only on the last tooth of this series is there any indication of a deuteroconid. This is another character like that of *Trigonolestes*, and decidedly different from the bunodont Creodonta (*Sarcothraustes*).
3. The inferior true molars are quinquetubercular in structure, there being a well-developed paraconid. The presence of this latter cusp probably proves that the type of lower molar found in *Protogonodon* should be associated with a superior molar, which is tritubercular.
4. The elongated and slender lower jaw of *Protogonodon*, especially the marked shallowing anteriorly, is like that of *Trigonolestes*, and the selenodont Artiodactyla in general.

Article II.—FOSSIL MAMMALS OF THE UINTA BASIN. EXPEDITION OF 1894.

By Henry Fairfield Osborn.

I.—Introductory Notes.

The mammalian life of the upper Eocene of North America is clearly recorded in four old lake basins, the northern or 'Wind River,' the west-central or 'Bridger,' the east-central or 'Washakie,' and the southern or 'Uinta.' The American Museum parties have now explored each of these four basins in succession, concluding with the Uinta exploration, which is the basis of this report.

This uppermost or latest of the Eocene lake sediments was made known by Marsh[1] in 1870. A fuller exploration of the Uinta by a party under Scott and Speir in 1886 resulted in the memoir, 'The Mammalia of the Uinta Formation,'[2] published in 1889 by Scott and Osborn. The American Museum sent Mr. O. A. Peterson into the Uinta in the autumn of 1893, but owing to restrictions upon the Uncompahgre Indian Reservation he was obliged to return after having secured only a few fossils. In the late summer and autumn of 1894, however, aided by Major Randlett, of Fort Duchesne, and by a permit from the Secretary of the Interior, Mr. Peterson was far more successful. He secured for the Museum a complete geological section along the White River, a collection representing about 150 fossil mammals, many of which are new, because his search was mainly in older and lower levels than those previously explored. A preliminary study of this fauna leads to the following results :

1.—General Results.

1. Beneath the true Uinta fauna is a distinct fauna transitional to the 'Washakie' and 'Bridger' of the east- and west-central basins. This contains undoubted horned ancestors of the Titan-

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[1] 'On the Geology of the Eastern Uinta Mountains.' Am. Jour. Sci., 1871, p. 191-198.
[2] Trans. Am. Phil. Soc., May 17, 1889.

otheres, yet of an older type than *Diplacodon*, because the premolar teeth are simple. With these forms are found surviving members of the distinctively Bridger types, such as *Uintatherium*, also several forms which have hitherto only been found in Washakie, such as *Achænodon*. Still more surprising is the appearance upon this sub-Uinta level of species of *Elotherium* and *Hyænodon*, genera which have been considered of a distinctively Lower Miocene age.

Below this level is a still older fauna not yet fully explored, containing a number of typical Washakie forms, also a new type of large mammal, *Sphenocœlus*, apparently hitherto not known.

2. Species of *Telmatotherium* abound in the sediments of this sub-Uinta level, and confirm Earle's prediction that this genus was ancestral to the Titanotheres. No true *Palæosyops* has thus far been found. *Telmatotherium cornutum* is in one of the direct ancestral lines leading to the Titanotheres. It shows a flat cranium, very long nasals and small naso-frontal horns. It was anticipated by *T. vallidens* of the Washakie, with horns in a still more rudimentary stage.

3. The smaller fauna of the basin hitherto recorded is increased by a new rodent related to *Paramys*, and a new Monkey related to *Microsyops*.

4. The full characters of *Amynodon intermedius* are given by the complete skeleton of a young individual obtained in the true Uinta.

These results are so important, and give such large promise for the future, that the Museum has sent a party back into the Uinta for the third and more thorough exploration of 1895.

2.—Geology of the Uinta Basin.

Mr. O. A. Peterson contributes the following preliminary observations upon the geology of the Basin: "The Uinta Basin of northeastern Utah is bounded to the north by the Yampa and Uinta Mountains, to the west by the Wahsatch Mountains, and to the south and east by the Tavaputs Plateau and Book Cliffs. The basin is drained through the centre by the Green River with its tributaries the White River of Utah on the east, and the Duchesne River on the west; these enter almost opposite one another near the Indian Agency of Ouray.

"1. As we enter the southeastern border of the basin overlooking Book Cliffs, some thirty miles south of White River, the *Wahsatch* or Coryphodon beds are met with, resting upon the Cretaceous, but as I did not explore this I cannot add anything to what is known as to the relations between the Laramie and Wahsatch sediment at this point. The entire sedimentary mass in this basin dips northwestwardly at an angle of about 8°, and is observed unconformably resting upon the upturned edges of Laramie, especially along the northern border of the basin.

"2. Conformably overlying the Wahsatch are the *Green River Shales*, identical in appearance with the corresponding series in the Bridger Basin, and attaining nearly the same thickness. As we cross the basin northwestwardly from Book Cliffs we reach the White River near the Colorado and Utah State line. Some forty miles west of its junction with Green River the White River cuts through the Tertiary rocks exposing cañons and vertical walls of sometimes 400 to 500 feet in thickness from the river bed to the top. Here we obtain fine stratigraphical sections.

"3. Conformably overlying the Green River shales is a series of *hard brown sandstones* of the same character as sandstones which are found capping these shales north of the Uinta Mountains. Alternating with this brown sandstone are clay layers of a greenish-gray color, and this whole series reaches a thickness of about 800 feet. Specimens were found in the sandstone ledges of this series which represent true Bridger types. Overlying this series is a well-marked stratum of a light reddish color about 20 to 40 feet thick. This is especially noticed in the eastern part of the basin where the most satisfactory stratigraphical sections can be obtained.

"4. The most important and faunally rich series of sediments in the Uinta basin immediately overlies and conformably succeeds the last mentioned reddish clay stratum. These beds are about

350 to 400 feet thick, and are composed of coarse brown sandstones with alternating clays. The largest part of the vertebrate collection secured by the party is from this level, and is of great interest owing to its transitional relationship between the true Bridger and the Uinta fauna.

"5. We now reach the *true Uinta*[1] or Brown's Park beds of a fine-grained soft material much the same in appearance as the characteristic Bad Lands of South Dakota, with the exception of the color which is of a brick red ; in fact, the reddish tinge holds good throughout the entire Uinta sediment. At a distance these beds present a ferruginous aspect, and are about 600 feet thick. This uppermost strata of the Uinta Basin has hitherto been reported[2] as resting unconformably upon the underlying Bridger sediment, but no observable breaks were found to distinguish the true Uinta from the underlying Bridger sediment. So the writer found it necessary in collecting fossils to divide the beds overlying the Green River shales into three different levels, which are here arranged alphabetically in ascending position :

"Horizon *C.*—True Uinta beds 600 feet thick. Sandstones and clays brownish and reddish, ferruginous. The strata are sometimes evenly bedded and firm, but often irregular and friable, and present the characteristic Bad Land appearance where the erosion has been most complete. This is the level in which the Yale College and the Princeton expeditions have made their explorations, and it contains the true Uinta fauna.

"Horizon *B.*—300 feet thick. Soft coarse sandstones and clays.

"Horizon *A.*—800 feet thick. Hard brown sandstones immediately overlying the Green River Shales."

3.—The Three Faunal Levels.

These excellent observations supply one of the most important links in the American lake faunal chain, namely that between the

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[1] King, U. S. Geological Exploration of the 40th Parallel, Map 1.

[2] Charles A. White, 'On the Geology and Physiography of a Portion of Northwestern Colorado and Adjacent Parts of Utah and Wyoming.' U. S. Geol. Survey, Ninth Annual Report, p. 690–1.

Washakie and the Uinta. The explorations of the present year, 1895, may modify these results, but it is certain we have now not only established a complete faunal transition from the Bridger and Washakie beds upon the one side, to the true Uinta level or Horizon *C* upon the other, but have demonstrated a closer connection between the fauna of this basin and that of the lowest White River Miocene.

SUCCESSION OF SPECIES IN THE UINTA BASIN.

(*Museum Catalogue Numbers.*)

HORIZON *C*.—UPPER LEVEL. *Diplacodon elatus beds.* About 600 feet. Brown and red sandstones and clays, ferruginous.	(Am. Mus. Exp., 1894.)—Mesonyx, 1505. Miacis uintensis, 1895. Diplacodon, 1853, 1853a, 1861–2. Amynodon intermedius, 1933; indet., 1934–5, 1506. Isectolophus annectens, 1827–8, 1927. Triplopus ? obliquidens, 1928. Epihippus ? uintensis, 1930. Protoreodon and Leptotragulus, 1800–18, 1826-a. Incertæ sedis, 1829, 1874. (Princeton Exp., 1886.)—Mesonyx uintensis, Hyopsodus gracilis, Plesiarctomys sciuroides, Leptotragulus proavus, Protoreodon parvus, Diplacodon elatus, Amynodon advenus, Miacis vulpinus.
HORIZON *B*.—MIDDLE LEVEL. *Telmatotherium cornutum beds.* About 350 feet. Soft coarse sandstones and clays.	Microsyops uintensis, 1899, 1900. Miacis uintensis, 1896. Mesonyx uintensis, 1892. ? M. obtusidens, 1891. ? Hyænodon, 1893–4. Paramys uintensis, 1901. Telmatotherium cornutum (skulls), 1845–52, 1837, 1868; (jaws), 1854–5, 1858–9. T. hyognathum, 1856. T. diploconum, 1863, ? 1870–1; (skeletons), 1831–44, 1860, 1869, 1872. Incertæ sed., 1864–7. Amynodon, 1932, 1936, 1830. Helaletes guyotii, 1829. Epihippus, 1930. Achænodon insolens, 1819, 1825. Elotherium uintense, 1820–24, 1826 b, c. Uintatherium, 1884–1890.
HORIZON *A*.—LOWER LEVEL. *Telmatotherium megarhinum beds.* About 800 feet. Hard brown sandstone.	Telmatotherium megarhinum, 1500, ? 1864–5, 1876, 1877. Amynodon, 1878. Triplopus, 1879. Indet., 1501–4, 1880. Uintatherium, 1881. Sphenocœlus uintensis.
GREEN RIVER SHALES.	

C.—Upper level. True Uinta. *Diplacodon elatus* beds. This is the level of the Princeton and probably the Marsh explorations. It is distinguished by the presence of three genera—*Diplacodon*, *Protoreodon*, *Leptotragulus*—which have thus far not been found below. It contains, however, several species which have also been found in the middle level. It is apparently distinguished by the *absence* of *Uintatherium.*

B.—Middle level. Transitional. *Telmatotherium cornutum* beds. This is a rich faunal level, hitherto unknown. *Telmatotherium cornutum* is very abundant. This is related to the White River or Lower Miocene by the presence of an ancient species of *Elotherium*, and probably of *Hyænodon.* It is related to the upper level, *C*, by similar species of *Mesonyx*, *Amynodon* and *Epihippus*, but is distinguished from *C* by the *presence* of *Uintatherium.* It is related to the eastern or Washakie Basin by the presence of *Telmatotherium hyognathum* and *Achænodon insolens*, and apparently to the Bridger by *Helaletes guyotii* and *Mesonyx obtusidens*, both of which determinations are however somewhat doubtful.

A.—Lower level. Base. *Telmatotherium megarhinum* beds. This level has been comparatively little explored. It contains *T. megarhinum*, also found in the Washakie, besides *Amynodon*, *Triplopus* and *Uintatherium.*

We have now to ascertain what type of *Uintatherium* existed as a contemporary of *Telmatotherium cornutum.* Judging from the limbs, it was a very large animal, and will not improbably be found to belong to the *Uintatherium cornutum* Cope, which was obtained at the summit of Haystack Mountain, or the very top of the Washakie beds.

II.—PRELIMINARY DESCRIPTIVE REPORT.

PRIMATES.

There are apparently numerous remains of Monkeys, Rodents and other small animals in a large block of sandstone, not yet worked out. We add a new type of *Microsyops.*

Microsyops uintensis, sp. nov.

Third premolar elevated and laterally compressed. Fourth premolar very small with three cusps in trigonid ; a very small and short talonid. First molar with paraconid. Second molar lacking paraconid.

The only Primate hitherto found in the Uinta Basin is *Hyopsodus gracilis* Marsh. The type of this new species (No. 1899) is a small jaw containing two premolars and two molars. It comes from the '*T. cornutum* level,' and is distinguished from the *M. gracilis* Leidy by the greater complication and relatively reduced size of the fourth premolar. The submolariform structure of $P_{\overline{4}}$, and the enlarged lateral pair of incisors, are the distinctive features of this genus. There is also an isolated lower molar, No. 1900.

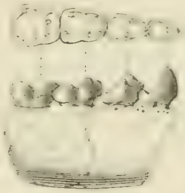

Fig. 1. *Microsyops uintensis*, type, No. 1899. Lower jaw, internal view ; superior view. One and a half natural size.

CREODONTA.

The Uinta Basin Creodonta thus far known are *Mesonyx* and *Miacis*. We add an apparently new form related to *Hyænodon*.

Miacis uintensis, sp. nov.

Fourth lower premolar with a high protocone bearing two cuspules upon the posterior slope, terminating in a talonid ; no cingulum. The third lower molar either very small and single-fanged or wanting.

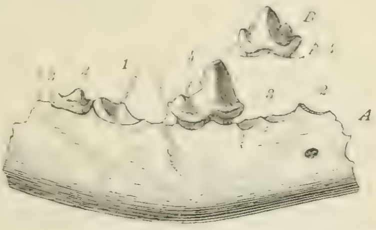

Fig. 2. *Miacis uintensis*. *A*. Type, No. 1896. External view of jaw, natural size. *B*, Fourth lower premolar, No. 1895.

The type lower jaw of this species (No. 1896) was found in *B*, close beneath the true Uinta level. It differs from *M. vulpinus* Scott in the structure of the fourth premolar, a tooth which in the latter species presents a complete cingulum and no cuspules. The trigonid of $M_{\overline{1}}$

is broken off, the talonid is broad and elevated upon the outer side. M$\overline{2}$ is a small tubercular with a complete but very much depressed trigonid and a narrow talonid. M$\overline{3}$ is represented by a very small single alveolus. Another jaw from the true Uinta level (No. 1895) contains a fourth premolar, which presents the same characters as the above.

? Hyænodon.

This genus is apparently represented by a jaw (No. 1893) from the middle or '*T. cornutum* level,' in which the teeth are too poorly preserved to afford means of definition. It is, therefore, not taken as a type. It presents many similarities to the *Hyænodon paucidens* jaw of the White River formation, especially in its very long stout symphysis and in its triple mental foramina. The specimen consists of a right mandible and a detached condyle. It contains the fang of a small lateral incisor and of a very stout canine. Behind this are two alveoli either belonging to two single-fanged teeth, P$\overline{1}$ and P$\overline{2}$—or to one tooth, bifanged P$\overline{2}$. The formula is therefore uncertain; it is either P, 4 or P, 3. The

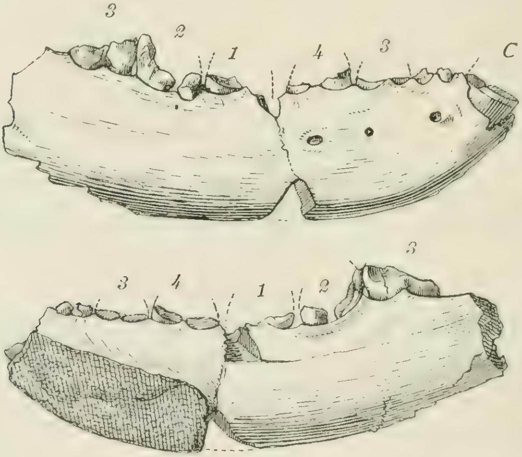

Fig. 3. *Hyænodon.* Lower jaw, No. 1893, internal and external views. Natural size.

missing third and fourth premolars were stoutly bifanged and of similar size. The three molars were also apparently equal sized, narrow and bilobed as in *Hyænodon.*

Another specimen (No. 1894) may also pertain to this species. It consists of fragments of a molar tooth and of the limbs.

Mesonyx *Cope.*

There are two individuals belonging to this genus, both from the '*T. cornutum* level.' The first is a smaller animal (No. 1891) represented by the lower jaws and hind limb with a perfect foot, corresponding nearly in size with the *M. obtusidens* Cope, so fully described by Scott. The second is a very large skull apparently related to the following species :

Mesonyx uintensis *S. & O.*

This powerful mesoplacental is represented by a skull (No. 1892) belonging to a slightly smaller individual than the Princeton type, which was founded upon a series of lower molar teeth.

Measurements.

Total length of skull, estimated	.44	mm.
Incisors to condyles, "	.42	"
Length premolar-molar series	.137	"
Width across zygomatic arches	.27	"

The following are the principal characters : The cranium is slightly longer than the face. There is a high narrow occiput, extending forwards into a thin sagittal crest above a small brain-case. The frontals widen suddenly into a broad supraorbital plate which overhangs the rather small orbits. The nasals are long and narrow, but widen in the median line between the orbits. The maxillaries are compressed behind the canine, and perforated by an infraorbital foramen above M^1. The lachrymals are widely exposed upon the face. The zygomata are slender, but arch widely outwards and then suddenly descend into the glenoid fossa, which is very deep and presents sharp pre- and post-glenoid crests. Behind the glenoid region the skull is very short and the paroccipital plate is relatively narrow.

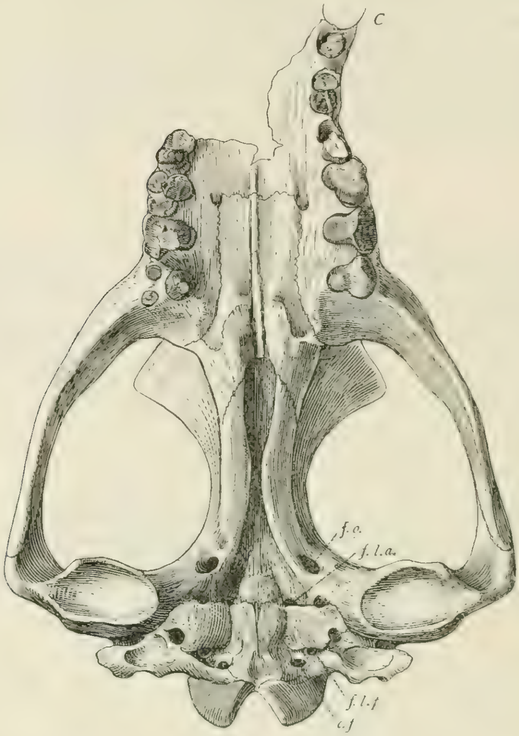

Fig. 4. *Mesonyx uintensis.* No. 1892. Base of skull. One-quarter natural size.

Foramina.—There is a strong mastoid foramen. The for. ovale pierces the ridge between the glenoid fossa and the pterygoid border. The periotic fills in the auditory meatus inferiorly, compressing the for. lac. medius and f. l. posterius into small spaces, behind which are the small condylar foramina.

The most distinctive feature of the skull is the backward extension of the posterior nares and the inclosure of the roof of the pharynx by two long palato-pterygoid plates, the lower borders of which incline towards each other in the median line so as almost to come in contact. This is paralleled by the well-known inclosure of the same region in certain species of *Hyænodon.*

We are also struck by the many points of parallelism which this skull presents with that of *Elotherium uintense*, a totally unrelated form. These parallelisms are undoubtedly attributable to adaptive conformation in both cases to a type of dentition and a mode of mastication which have many points in common.

RODENTIA.

This order is represented by a large number of remains of jaws and skulls contained in a block (Nos. 1907–1919) which has not yet been worked out. There are also the small undetermined jaw (No. 1908), the larger jaw (No. 1906) corresponding in size with *Plesiarctomys sciuroides*, and a number of upper and lower teeth which probably belong to *Paramys* Leidy.

Paramys uintensis, sp. nov.

Upper molars quinquetubercular with posterior cingulum and a mesostyle. Lower molars quadritubercular. Crown crenulate.

The type (No. 1901) is from the '*T. cornutum* level,' and deserves description. The upper molars are strictly tritubercular with slight anterior and prominent posterior basal cingula; the three primary cusps (paracone, metacone and protocone) are prominent, as are also the two intermediates (protoconule and metaconule). The lower teeth are much larger than in Leidy's types of *P. delicatus*, *P. delicatior* or *P. delicatissimus*. Marsh's *P. robustus*[1] is still indeterminate, not having been adequately described or figured, although proposed twenty-three years ago. These teeth present a similar, irregularly quadritubercular crenulated crown, whereas in *Plesiarctomys* we observe a smooth low-crowned type. *P. uintensis* is further distinguished by the apparent absence of a paraconid.

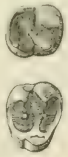

Fig. 5. *Paramys uintensis.* Type, No. 1901. Upper and lower molars, crown views. Twice natural size.

The upper molars furnish another link in the chain of evidence that the ancestors of the Rodents were tritubercular.

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[1] Am. Journ. Sci., Sept., 1872.

AMBLYPODA *Cope.*

Uintatherium *Leidy.*

The discovery of remains of this genus in the Uinta Basin is an important one. In Horizon *A* was found the head of a humerus (No. 1881). In the more fully explored Horizon *B* remains of seven individuals were found, as follows: Occipital region of a skull (No. 1884), a humerus (1885), two femora (1880–87), frontal horns of two individuals (1889–89*a*), miscellaneous footbones of several individuals (1890).

We look forward with interest to the discovery of a skull from this level.

PERISSODACTYLA.

TITANOTHERIIDÆ.

PALÆOSYOPINÆ.

One of the chief results of this expedition is the clearing up of the cranial and dental characters and of the systematic position of *Telmatotherium*, a work which has been so ably begun in Earle's Memoir.[1] Numerous remains of the skeleton were also procured, but the description of these is reserved for a subsequent paper.

Historical Notes.—The following characters were assigned to *Telmatotherium validum* by Marsh[2] in 1872:

1. Premaxillaries compressed with an elongated median suture. Zygomatic arch slender. Upper molars with inner cones elevated and pointed, and with a well-developed basal ridge. Upper canines large, pointed, with strong cutting edges. Incisors with inner basal ridge. Palate deeply excavated between the premolars. Nasals decurved laterally and much compressed. Last upper molar with a single internal cone. Diameter upper premolar-molar series, 224 mm. Type species, *Telmatotherium validus* Marsh. Specimen found at Henry's Fork in the Main Bridger Basin. Date, July 22; separata, August 1, 1872.

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[1] 'A Memoir upon the Genus Palæosyops Leidy and its Allies,' Journ. Acad. Nat. Sci. Phila., Vol. IX.

[2] Am. Journ. Sci. and Arts, Aug., 1872.

Four species have been subsequently described :

2. The second species *T.* (*Palæosyops*) *vallidens* Cope[1] was named by Cope September 19, 1872, from a series of upper premolars and molars found in the Bitter Creek region or Washakie Basin. It was, however, identified with *Palæosyops* and distinguished from *P. major* as follows: Molar teeth larger. Superior molars with two transverse ridges connecting the inner tubercle (protocone) with the outer crescents (paracone and metacone) enclosing a pit between them. Premolars with outer crescents fused into a single ridge. Summits of all the crescents elevated. All the teeth with strong internal basal cingula which rise up on the inner tubercle (protocone). Diameter upper premolar-molar series, 220 mm.

3. The third species described was the *T.* (*Leurocephalus*) *cultridens* of Scott and Osborn[2] in 1878. The type specimen is an upper jaw with a complete set of teeth and part of a lower jaw with the grinding teeth. Also the posterior portion of one of the nasals and a part of the frontals. Diameter upper premolar-molar series, 190 mm. The authors distinguished this type clearly from *Palæosyops* but not from *Telmatotherium*, with which Earle has shown it to be identical, although specifically distinct from *T. validum*. The locality is Henry's Fork, Bridger Basin.

4. The fourth species, *T.* (*Palæosyops*) *hyognathum*, was established by Scott and Osborn[3] in 1889, upon a very large jaw found in the Bitter Creek or Washakie Basin. It was characterized by its close series of procumbent incisors ; a symphysis extremely long and shallow ; the canines rather small and semiprocumbent ; diameter of lower molar-premolar series, 245 mm ; a large inferior diastema. Evidently related to *Diplacodon*.

5. The fifth species, *T.* (*Palæosyops*) *megarhinum*, was proposed by Earle[4] in 1891 upon a fine skull, also from the Washakie Basin (Princeton Mus., No. 10,008). The teeth in this type are badly damaged, so that new skull characters only could be assigned, namely : Molar with a shelf-like suborbital process ; face very short ; nasals very long, expanded distally ; premaxillary symphysis short and narrow ; palate narrow and arched. Diameter premolar-molar series, 148 mm. No superior diastema.

6. The new species *T. diploconum* and *T. cornutum* are here proposed.

The type of *T. validum* Marsh has not yet been figured, and its specific characters are still indefinitely known. The Museum collection now contains specimens which we refer to *T. vallidens*, *T. hyognathum* and *T. megarhinum*, besides the new species *T. diploconum* and *T. cornutum*.

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[1] Proc. Am. Phil. Soc., Sept. 19, 1872, p. 487.
[2] Bull. E. M. Museum Geol. & Arch., 1878, p. 42.
[3] 'Mammalia of the Uinta Formation.' Trans. Am. Phil. Soc., 1889, p. 513.
[4] Am. Nat., Jan., 1891, p. 46.

Telmatotherium *Marsh.*

A genus partly contemporary with *Palæosyops*, but transitional in evolution to *Diplacodon*. An incipient fronto-nasal horn in the latest species. Nasals long and decurved laterally. Premolars simpler than molars. Upper molars with high pointed cusps, paracone and metacone approximated to protocone; conules reduced or wanting.

Comparative Measurements.

	Molar-premolar series.	Total length skull.	Width zygomatic arches.
Telmatotherium validum	.224		
" vallidens, type.....	.220		
" " No. 1569.	.184	.500	.33
" cultridens	.185		
" hyognathum, lower.	.239		
" megarhinum, type..	.145		
" " No. 1500.	.147	.355	.14
" diploconum	.174	? .450	? .216
" cornutum	.208	.565	.243

Telmatotherium megarhinum *Earle.*

Superior premolar series, 148. No diastema. A broad suborbital shelf. A long narrow sagittal crest.

When Earle established this species he left its generic position open, owing to the fractured condition of the teeth. The very complete skull (No. 1500) procured in 1893 from the lowest level, or *Hor. A*, contains perfect teeth, which are of the *Telmatotherium* type; this fact, together with the presence of an infraorbital shelf, as in the *T. cornutum* type, determine the generic position of this species. But this species with its long, thin and high sagittal crest presents a far more primitive condition than *T. cornutum*. It differs from *T. cultridens* also in the small oval section and short enamel area upon the canines, as well as in the infraorbital shelf and the posterior position of the infraorbital foramen.

Its general characters are as folllows: *Superior dentition:* The incisors are small, nearly continous, with a rounded anterior contour. The canines are small and rounded. The premolars 2–4 present large single internal cones. The molars exhibit basal cingula at the bases of the para- and metacones. There is a small hypocone upon M3.

The malars present a thin shelf. The zygomata diverge slightly posteriorly. The brain-case is small, and the sagittal and occipital crests are very prominent ; the latter spread superiorly. The orbits are small and sunken, bounded by hook-shaped postorbital processes upon the frontals. The posterior nares open opposite the second molar. The postglenoid process is small. The premaxillary symphysis is apparently long. The infraorbital foramen is just at the anterior margin of the malar, and the space between the orbit and the nasal notch is very short. We also refer Nos. 1864–5 to this species and numerous skeletal remains.

Telmatotherium diploconum, sp. nov.

Superior premolar-molar series, 174 mm. A large hypocone upon last upper molar. Naso-frontals without horn. Long sagittal crest. Canines small, rounded.

The type is a skull (No. 1863) in which the nasals are wanting and the mid-region of the cranium was crushed. This type is remarkable in being of the same stage of evolution as *T. cultridens*, and yet occurring in the same level as the far more modernized *T. cornutum.*

This species differs from *T. megarhinum* in the absence of the infraorbital shelf, and in the presence of a large hypocone upon the last upper molar. The premolar-molar dentition is similar in size and form to that of *T. cultridens*, but there are the following important general differences : (1) Canines small and circular in section ; (2) a very short diastema, if any, behind the canine ; (3) a large hypocone upon $\underline{M^3}$; (4) the infraorbital foramen close beneath the anterior border of the molar.

In several respects it distantly resembles *T. megarhinum.* The occiput is small and high. There is a long sharp sagittal crest extending about halfway forward to the orbits. The posterior nares is opposite the second molar.

The premaxillary symphysis is relatively short. The zygomata are nearly parallel with the side of the skull, but they arch upwards posteriorly ; there is a very prominent postorbital process. The form of the molar, at its junction with the premaxillaries, is very similar to that in *T. cultridens*, but the infra-

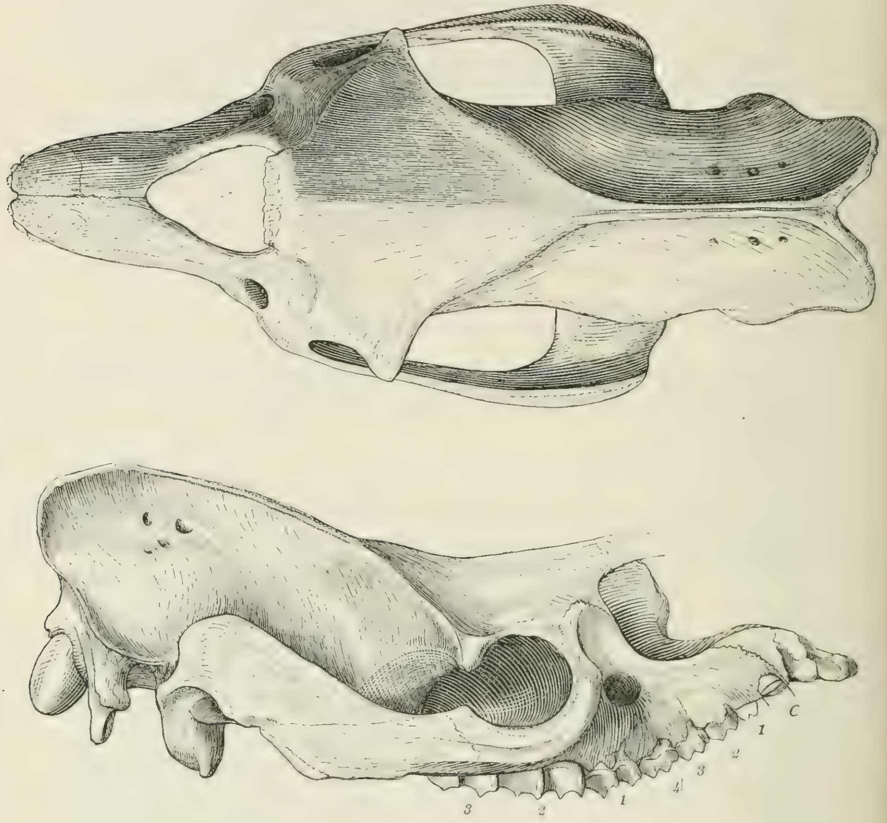

Fig. 6. *Telmatotherium diploconum.* Type, No. 1863. Superior and lateral views of skull. One-fourth natural size. The nasals are broken off.

orbital foramen is immediately in front of the suture, instead of being placed well forwards. The incisors are wanting. The canines are very small and circular in section at the base. The second premolars are in a slightly more advanced stage of evolution than in *T. cultridens.* The outer lobes of the molars are very much elevated, with feeble basal cingula. The hypocone of $M^{\underline{3}}$ is quite as large as those of $M^{\underline{1}}$ or $M^{\underline{2}}$.

Telmatotherium hyognathum *S. & O.*

Incisors, $\frac{3}{3}$. Inferior premolar-molar series, 224 mm.; lower molar cusps high and pointed. Three lower incisors. Lower canines rounded, followed by a wide diastema.

This species is represented by a very large pair of lower jaws (No. 1856) containing *three* incisors and agreeing in all other respects with the type of *T. hyognathum.* It is noteworthy that the canines have short enamel crowns and are formed like those of the Miocene Titanotheres, but the jaw itself differs widely from the Titanothere type in the long shallow symphysis.

Telmatotherium vallidens *Cope.*

Superior premolar-molars series, 184–220 mm. A narrow diastema. Molar cusps less elevated. A rudimentary naso-frontal tuberosity. Premaxillary symphysis short. Top of cranium flattened; very short bifid sagittal crest.

The examples of this species are not from the Uinta but from the *Washakie* Basin, and were found by the Bridger expedition of 1893 in a brown layer of sandstone three miles north of the base of Haystack Mountain upon Bitter Creek. They are described here as an important link in the Telmatotherium series. The molar teeth as displayed in the two skulls (Nos. 1569, 1570) agree closely in every detail with those of Cope's type[1] also found in this basin, although they are considerably smaller, measuring only 184 mm. as against 220 mm.[2] They are distinguished from the molars of *T. vallidum* (Marsh) by the lower and more obtuse cusps. The skull is distinguished by the short premaxillary symphysis. The species is distinguished from *T. hyognathum* by the very narrow post-canine diastema; from *T. cultridens* by more obtuse molars and by the naso-frontal tuberosity; from *T. cornutum* by the short posterior constriction of the temporal ridges into a bifid sagittal crest.

When these skulls were discovered they were described by Dr. Wortman, in a letter from the field, as *Manteoceras* or 'prophet-horned.' But in the Museum great doubts were expressed by

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[1] See Tertiary Vertebrata, Plate 51, Fig. 1.

[2] It appears as if Cope's measurements were erroneous.

Professor Cope and by others who examined them as to whether the tuberosities (*H*) above the orbits could really be regarded as incipient horns. These doubts have now been removed by the discovery of *T. cornutum*, and Dr. Wortman's observation is verified.

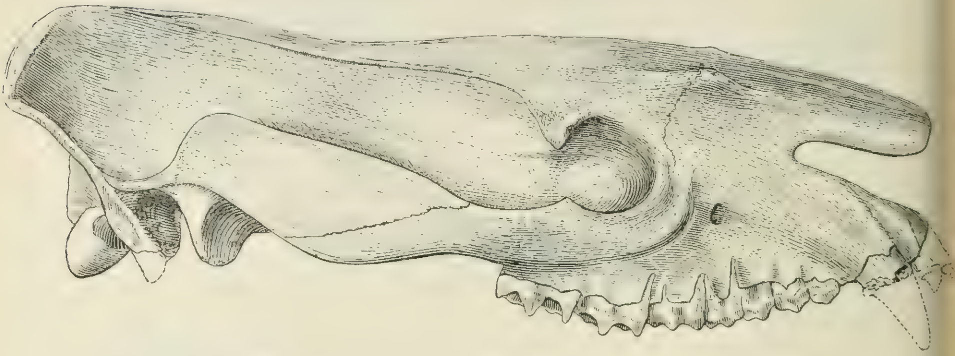

Fig. 7. *Telmatotherium vallidens.* Composition, Nos. 1569–70. Side view of skull. One-fourth natural size.

T. vallidens presents the first transitional features towards *T. cornutum* and the later Titanotheres. The horns exhibit the most rudimentary stage imaginable; they are borne more upon the frontals and less upon the nasals than in *T. cornutum.* The cranium is broad upon the upper surface between the orbits and narrows very gradually towards the occipital region, where the two temporal crests converge. They do not, however, unite into a single sagittal crest, but leave a deep median pit followed by a narrow valley which opens out into a triangular space between the occipital crests. The occiput is very broad and low.

In addition to those above mentioned, there are other features which separate *T. vallidens* from *T. cornutum*, especially (1) the absence of an infraorbital shelf upon the malar, (2) the short wide-spreading and relatively heavy form of zygomatic arches, (3) the relative shortness of the nasals, (4) the more slender postglenoid processes, (5) the shortness of the premaxillary symphysis. In general the face and the nasals are relatively shorter in *T. vallidens* than in *T. cornutum;* there is little or no diastema behind the canines; the posterior nares open much further forwards, or

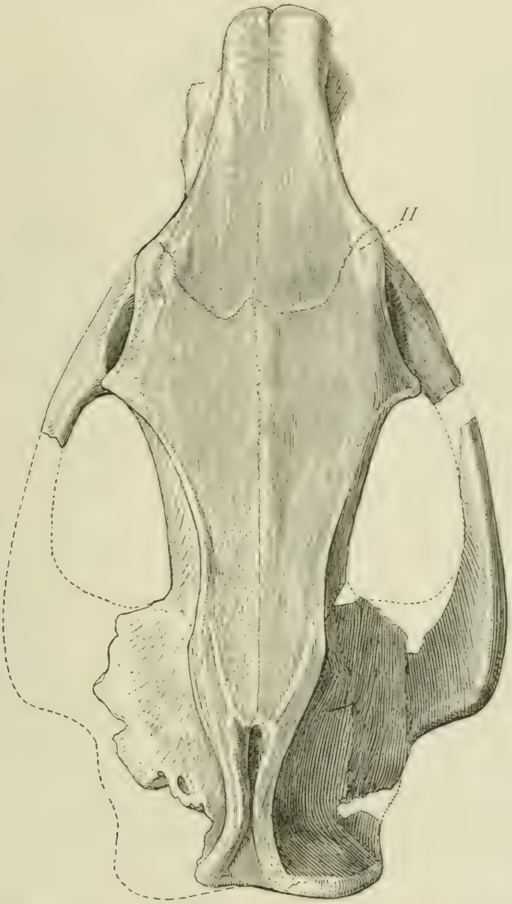

Fig. 8. *Telmatotherium vallidens.* No. 1569. Superior view of skull. One-fourth natural size.

between the second molars; there is no trace of a hypocone upon $M^{\underline{3}}$.

The canine crowns are wanting; they are rounder in section and much more powerful than in *T. cornutum.* The opposite molar series are not so nearly parallel. The true molars exhibit the Telmatotherium type, but it is less sharply defined than in *T. cultridens* or in *T. cornutum.*

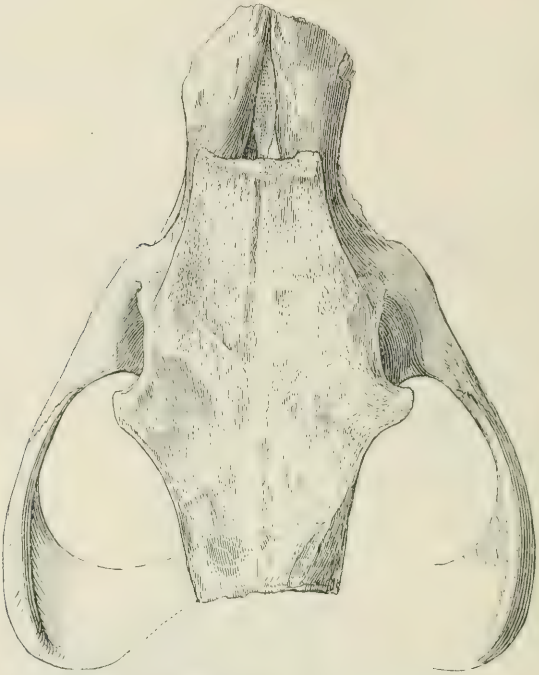

Fig. 9. *Telmatotherium vallidens*. No. 1570. Superior view of skull. The upper surface of the frontals and nasals is abraded.

There are only a few resemblances to *T. cornutum*, such as the proportion of the teeth and the development of basal cingula, the reduction of the intermediate tubercles upon the molars. The general conformation of the zygomatic arches presents an affinity to that of the *Titanotherium bucco* type of the Miocene.

Telmatotherium cornutum, sp. nov.

Incisors $\frac{3}{2}$. Premolar-molar series, 208 mm. A narrow diastema. Upper canines lanceolate. Long premaxillary symphysis. A well-developed nasofrontal protuberance. Top of cranium completely flattened. No sagittal crest. An infraorbital process upon malar.

The type of this species is a fine skull (No. 1851), while several other well-preserved skulls from the same levels give us all the

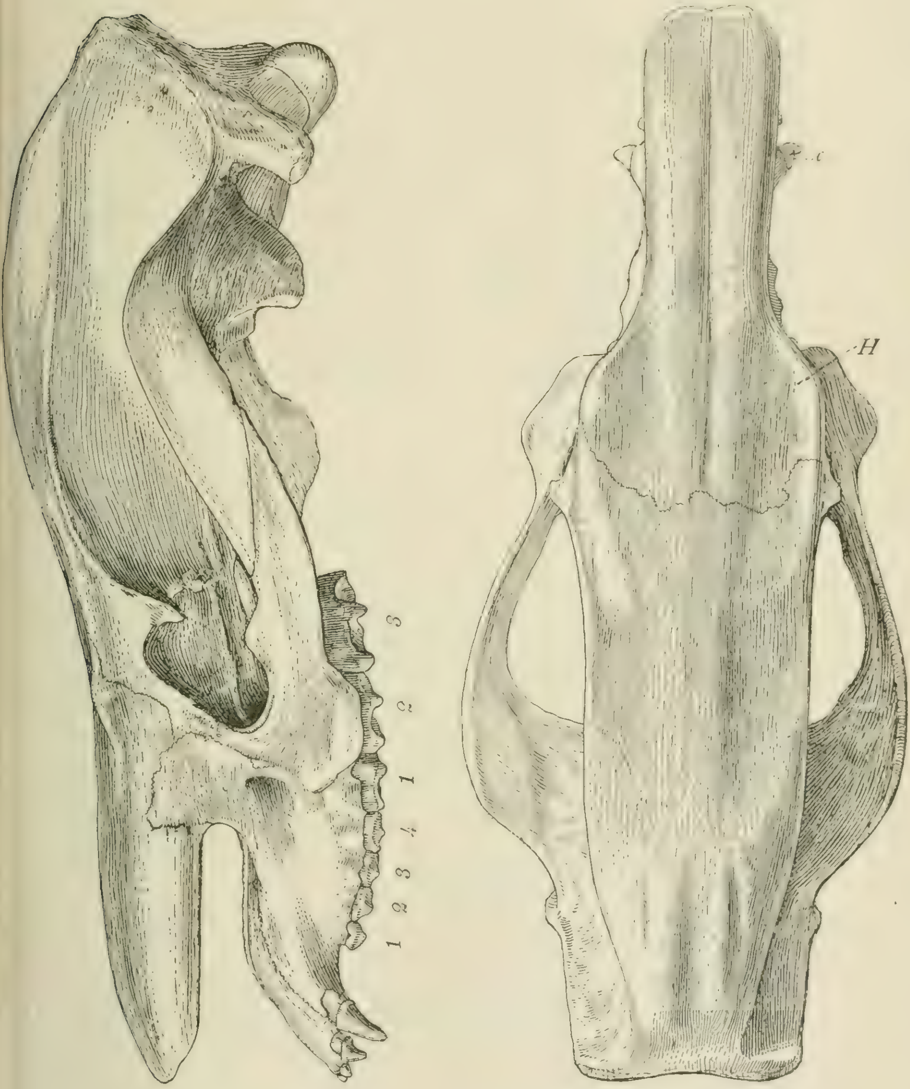

Fig. 10. *Telmatotherium cornutum.* Type, No. 1851. Superior and side views of skull. One-fourth natural size. Fronto-nasal horn at *H*.

cranial characters and the superior dentition (Nos. 1850, 1847, 1848, 1852, 1837). Unfortunately none of these skulls have the jaws associated with them, but several more or less perfect jaws, although found apart, agree perfectly in size (Nos. 1857, 1858, 1854, 1855); they are all readily distinguished from the jaw of *T. hyognathum* by the presence of *only two incisors*.

This species is remarkable for its very long flat-topped cranium and its incipient knob-like osseous horns borne chiefly upon the nasals but partly upon the frontals. These horns project laterally and rise slightly above the general surface, and are best seen in the anterior view, Fig. 10. These characters and the absence of the fronto-parietal and interparietal sutures all point well towards *Titanotherium*, but the premolars are still absolutely simple, showing no trace of the postero-internal cusps which characterize *Diplacodon elatus*.

Other striking peculiarities are the upward arching mid-cranial region, the extremely long, narrow and laterally decurved nasals; the strong infraorbital shelf upon the molars (seen also in *T. megarhinum*), the slender zygomatic arch, the low occiput, the backward extension of the posterior nares by the palatines, and the partial inclosing of the roof of the pharynx by the pterygoids.

More in detail (No. 1851) the *nasals* almost overhang the premaxillaries, they are laterally compressed above the infraorbital foramina so as to give the impression of distal expansion ; the median fronto-nasal suture extends back beyond the mid-orbital line, but laterally the nasals terminate just above the orbits so as to include most of the incipient horn. The *premaxillary* symphysis is elongate as in *T. validum*. The *maxillaries* are shut off by the very narrow lachrymals from the anterior border of the orbits. The infraorbital foramen is placed above $M^{\underline{1}}$ in front of the molar suture. The *molars* extend sharply upon the side of the face and then dip into the outwardly projecting shelf ; with an obtuse postorbital knob. The *frontals* exhibit a prominent postorbital hook ; there is a delicate lateral ridge marking the limits of the temporal fossa ; between these ridges the cranium is arched both from side to side and antero-posteriorly, presenting a very different form from the concave profile of even the oldest known Titanothere ; there is a slight constriction in the posterior third, but the cranium is even here two inches wide, and there is not the semblance of the crest seen in *T. vallidens;* the entire absence of the upper cranial sutures even in the young individuals (No. 1847) is a noteworthy Titanothere character. Owing to the sudden dipping of the superior contour the occiput is rather low and subquadrate in outline.

In side view the faint temporal ridges can be traced to the superior angle of the occiput. The zygomatic arch is very slender; it arches slightly upwards and very much less strongly outwards than in *T. vallidens.* The postglenoid process is very thick in antero-posterior section.

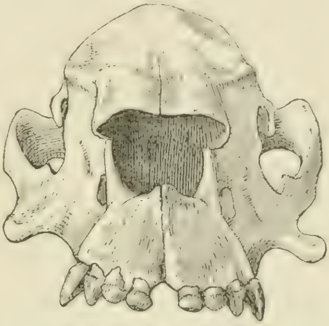

Fig. 11. *Telmatotherium cornutum.* Type. Anterior view of the skull.

In palatal view we observe a diastema between the median incisors and a post-canine diastema of 28 mm. The molar series are placed closely parallel so that the palate is long, narrow and deeply arched, and the posterior nares opens far back behind the last molar. The deep and long pterygoids arch towards each other in the median line, forming a deep fossa.

Foramina.—The alisphenoid canal is very long ; the for. ovale is widely separated from the for. lac. medium ; the for. lac. medium and the for. lac. posterius are very small and partly confluent ; the condylar foramen is midway between the condyles and the for. lac. medium.

Lower Jaw.—The most perfect of the lower jaws is No. 1857 ; it agrees in size exactly with the type skull No. 1851. In proportion it is rather shallow and slender, but presents somewhat more angulation of the chin than in *T. hyognathus.* The most distinctive character is the extremely long hook-shaped coronoid process which extends back over the condyle. The symphysis is long and rather shallow.

Dentition.—Inferior : A very distinctive and progressive feature is the presence of but two incisors in the lower jaw. The formula is thus $I\frac{3}{2}$, $C\frac{1}{1}$, $P\frac{4}{4}$, $M\frac{3}{3}$. A second Titanothere feature is seen in the relatively short, rounded canines of the lower jaw, which present a wide contrast with the compressed lance-shaped tusks of *T. validum* and *T. cultridens;* an especial feature is the absence of enamel upon the fang. It is to be noted, however, that the specific reference of these jaws is not certain.

Superior: The incisor series of the type (No. 1851) present a third circle, but the median incisors are separated by a slight space; they all exhibit prominent posterior basal cingula; the lateral incisor is considerably enlarged. The *canines* have short, outwardly and forwardly directed but slightly incurved crowns, with rather sharp borders, a suboval section and posterior basal cingula. Behind a short diastema is the first *premolar*, a simple, conical crown with an internal basal ridge; the second, third and fourth premolars exhibit *single* blunt or rounded internal cones, incomplete cingula, a strong antero-external (parastyle) and a feebler postero-internal (metastyle) ridge. The *molars* have the generic conformation; the third molar is the largest of the series, and exhibits a strong parastyle and mesostyle and a feebler metastyle; there is a strong cingulum at the outer base of the paracone, and a feebler one at the outer base of the metacone; the hypocone is feebly developed upon $M^{\underline{3}}$. All these teeth are well-worn, and the animal was fully adult.

The superior dentition of No. 1850 belongs to a younger animal with sharply defined characters. Here we see more plainly the resemblances to the type of *T. cultridens.* The canines are laniariform, with sharp lateral edges, basal cingula less marked and enamel continued far down. The outer faces of the premolars and molars are prominent and closely approximated to the internal cusps. We observe also a trace of the paraconule upon $M^{\underline{2}}$, and a distinct paraconule upon $M^{\underline{3}}$. In this specimen the pterygoids are long and not so deep.

Telmatotherium validum *Marsh.*

Superior premolar-molar series, 224 mm. Molar cusps high and pointed with rudimentary intermediate tubercles; last upper molar without hypocone. Second premolar with strong internal lobe. Premaxillary symphysis long? No infraorbital shelf.

For the sake of completeness this definition is framed from Marsh's brief description.

Telmatotherium cultridens *S. & O.*

Superior premolar-molar series, 190 mm. Molars with nearly obsolete conules. Second premolar with feeble internal lobe. Last upper molar without hypocone. Canines laterally compressed. Naso-frontals without tuberosity. Premaxillary symphysis long. No infraorbital shelf.

There are several possibilities of error in the separation of these species, and these cannot be removed until *T. hyognathum* and *T. validum* are known both in the upper and lower dentition.

AMYNODONTIDÆ.

The independent position of this family has now been completely established by the discovery in the Miocene of the complete skeleton[1] of *Metamynodon* showing four fully functional digits in the fore-foot. Additional characters of the family are brought to light by a second complete skeleton (No. 1933) found by Mr. Peterson in the true Uinta or upper level, Horizon *C.* The specific position of this animal is difficult to determine owing to the immature state of the dentition. It is provisionally referred to *A. intermedius* S. & O.

Amynodon intermedius *S. & O.*

Dentition: $I\frac{3}{3}$, $C\frac{1}{1}$, $DP\frac{4}{4}$, $M\frac{3}{3}$. Upper canines suboval in section, inclined forwards. Four deciduous premolars in both jaws. Four permanent premolars in the upper jaw.? Lower canines erect, triangular.

The skeleton is that of a half-grown animal. The epiphyses are detached from many of the limb bones and from all the vertebræ. As in all fossils from the clay matrix of this level the bones are considerably crushed. The adult was a rather slenderly built, long-limbed animal, exceeding the largest Tapir in size. The manus was considerably longer than the pes, but we observe a very slight disparity in length between the tibia and the femur, the radius and the humerus. The skull is broad and flat, of entirely different proportions from the skull of *A. antiquus*, which is high and narrow. It has the deep depressions in front of the orbits of *A. intermedius*, but a much longer face and longer nasals than in *Metamynodon.*

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[1] Foss. Mamm. of the Lower Miocene, White River Beds, Bull. Am. Mus. Nat. Hist., July, 1894, p. 208.

Measurements.

Total length of skull, premaxillaries to occiput...	.53	mm.
Length of humerus from facet to facet..	.302	"
" radius " " "	.305	"
" femur " " "	.36	"
" tibia " " "	.28	"
" metacarpal III....................	.163	"
" metatarsal III	.124	"
Os-innominatum, total length............	.47	"

Dentition.—There are three complete upper and lower incisors; the latter are well preserved, and exhibit a posterior basal ridge and median column. The permanent lower canines are erect and triangular, while the upper are directed slightly forwards and are rounded upon the outer and flattened upon the inner surfaces. These teeth are only partially extruded, and it is, therefore, difficult to compare their form with those of the type of *A. intermedius*. The four deciduous premolars are still in place. The molar teeth agree closely with the *A. intermedius* types in form and measurement.

Skull.—The cranium is considerably crushed. The premaxillaries are short, slender superiorly and barely in contact with the nasals. The maxillaries are deeply concave in front of the malar antorbital bar. The zygomatic arch is comparatively slender, wide below the orbit and not very deep; there are two knob-like projections, also characteristic of *Metamynodon.* The external auditory meatus is open below, and the paroccipital process is very slender, and curves forwards inferiorly. The occiput is rather broad and low, overhanging the condyles.

The base of the skull displays a rather broad, slightly concave palate, the posterior nares opening behind the second molar. The zygomatic arch spreads into a broad, flat triangular space around the glenoid fossa, the postglenoid crest being slightly everted.

The basi-cranial axis (basi-occipital and sphenoid, presphenoid) is a prominent ridge upon either side of which is a deep depression containing the for. lac. medium and posterius. The for. ovale is widely separated from the for. lac. medium, while the condylar foramen is very close to the for. lac. posterius. The alisphenoid canal is apparently very short ; the mastoid foramen is very distinct.

In the top view of the skull the nasals are relatively long; they are separated posteriorly by a median forward projection of the frontals. The brain-case is very large ; the sagittal crest is low and sessile.

The jaws resemble those of *A. antiquus* in the very high condyles and the narrow recurved coronoids.

Vertebræ.—The characters of the vertebræ have not yet been completely studied. The centra are rather small. The anterior dorsals present moderately long, slender spines.

Fore Limb.—The humerus is of the same total length as the femur, owing to its very broad and prominent great tuberosity, which is connected by a low ridge with the lesser tuberosity. The deltoid ridge is strong and rugose. The internal and external condyles are subequal in size. The ulna and radius are strikingly long and slender ; the ulnar shaft has a deep trihedral section ; the radius presents a shallow humeral facet. The metapodials of the manus are longer than those of the pes ; they are of high slender proportions ; the third metacarpal is slightly the longest, but the foot is functionally tetradactyl. The magnum is of the typical Rhinoceros form.

Hind Limb.—The innominate bones are elongate and slender. The superior border of the ilium is not evenly rounded, but is excavated towards the sacral border, and elevated and evenly arched towards the external border. The ischial border is straight, and the pubic border deeply incurved. The pubis is short and the ischium long. The obturator foramen is completed by an internal bridge, which is greatly reduced or wanting in *Metamynodon.* The acetabulum has a deep pit for the ligamentum teres.

The femur is distinguished by the antero-posterior diameter of the great trochanter, the small head with a large ligamentum teres pit, the antero-verted lesser trochanter, the prominent third trochanter slightly above the middle line, the moderately heavy shaft. The crus is somewhat shorter than the femur, but there is less disparity by far than in *Metamynodon*. The fibula is long and very slender. The astragalus is broad with a short neck. The calcaneum is distinguished by the flattened transversely placed tuber, as in *Metamynodon*. The cuboid is broad and flat, with a narrow calcaneal contact. There is no metapodial displacement; these elements are rather short and stout.

EQUIDÆ, TAPIRIDÆ, HELALETIDÆ.

The smaller Perissodactyla are represented by remains of *Epihippus*, *Isectolophus*, and *Helaletes*. The former (No. 1931), from the true Uinta, is represented by two femora and part of an astragalus, corresponding in size with the *Epihippus uintensis* S. & O. These parts of the skeleton are actually smaller than in Cope's type of *Hyracotherium venticolum* from the Wind River Beds, or base of the middle Eocene.

Several imperfect jaws and teeth (No. 1927) correspond in size with *Isectolophus annectens* S. & O. *Triplopus* is represented by a lower jaw (No. 1928) containing the fourth premolar and first molar.

From the '*Telmatotherium cornutum* level' comes also a fine maxilla (No. 1929) of *Helaletes guyotii* containing $\mathrm{P}\overline{4}$–$\mathrm{M}\overline{3}$. In this specimen the fourth premolar has two complete transverse crests, the metaloph being as elevated as the protoloph; it is, therefore, in a slightly more advanced stage of evolution than the Princeton type. The animal was also about one-fourth larger. It has not been hitherto reported from the Uinta Basin.

INCERTÆ SEDIS.

Sphenocœlus uintensis.

This new genus is represented by the posterior portion of a skull, which is distinct from any cranium known to the writer. Its most distinctive feature is the presence of a pair of pits in the

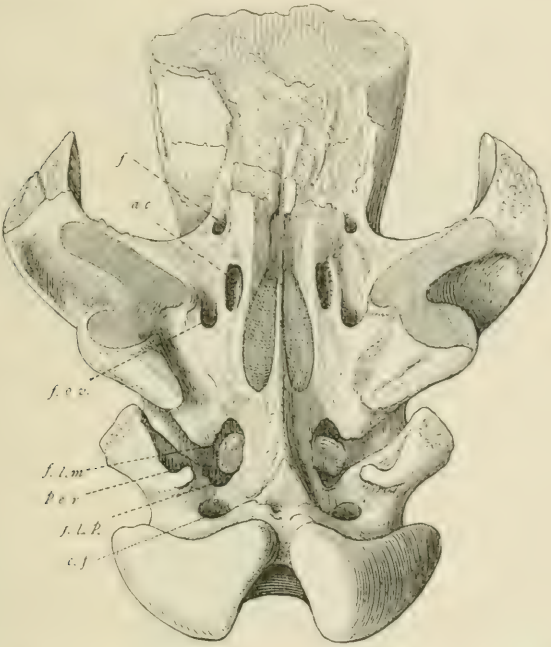

Fig. 12. *Sphenocœlus uintensis.* Type. Base of skull. One-fourth natural size.

floor of the skull upon either side of the narrow presphenoid. These pits were at first mistaken for the for. lac. media, but more careful investigation shows that they are roofed over by bone, and apparently do not communicate at all with the cranial cavity. The pit on the right side is perfectly preserved and clearly exhibits these characters. The measurements of the pits are 42 mm. long, 14 mm. wide, and 2 mm. deep.

The skull has a long narrow cranium surmounted posteriorly by a sagittal crest, which diverges anteriorly into two decidedly convex sagittal ridges. The occiput is rather broad, and below it are two widely set occipital condyles which are directed obliquely downwards and backwards. On either side of these the exoccipitals extend down into obtuse paroccipital processes, which are closely joined to the post-tympanics. The external auditory meatus is open inferiorly. In front of this the postglenoid

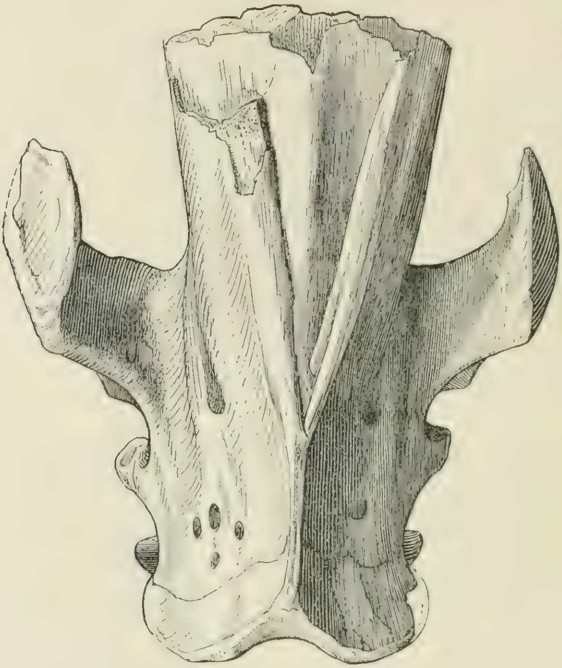

Fig. 13. *Sphenocœlus uintensis.* Superior view of cranium.

process faces somewhat inwards; the glenoid facet is L-shaped, two narrow arms extending out upon the squamosal, and a broad arm descending upon the postglenoid. The distinctive feature of the zygoma is the presence of a deep depression just behind the lateral arm of the glenoid facet.

Skull Measurements.

Width across zygomatic arches	.23	mm.
Height of occiput....	.142	"
Breadth "	.117	"
Breadth of occipital condyles...............	.13	"
Basi-occipital to top of sagittal crest............	.144	"

The foramina of the skull are related to those of the Perissodactyla, for there is a long alisphenoid canal, upon the outer side

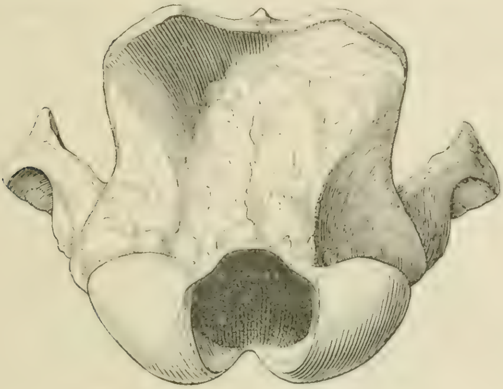

Fig. 14. *Sphenocœlus uintensis.* Occiput.

of the anterior opening of which is the foramen. Just behind the posterior opening of the canal is the foramen ovale, and between these foramina are the two pits above mentioned. This foramen is separated by a very wide plate of bone from the for. lac. medius, which is partly filled by the periotic mass.

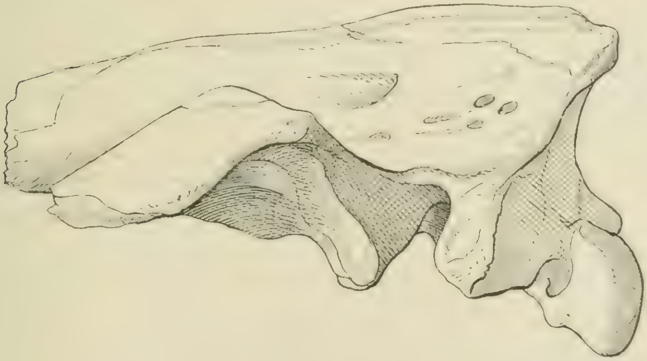

Fig. 15. *Sphenocœlus uintensis.* Side view of cranium.

The distinctive features of the skull may therefore be summed up as follows: Deep paired pits in the alisphenoids, and orbitosphenoids upon either side of the thin presphenoid; a long alisphenoid canal; foramen ovale widely separated from for. lac.

medium ; condyles very broad ; foramen magnum large ; occipital crest extending anteriorly into a short sagittal crest with convex sagittal ridges ; skull apparently long and narrow.

The relationships of this form are very difficult to determine. It has been compared with *Halitherium*, but without revealing any very close resemblances. The alisphenoid canal suggests that it is a Perissodactyle, and the form of the posterior portion of the skull is certainly very similar to that of *Chalicotherium*, but it lacks the robust tympanics observed in the European form, and exhibits the anomalous paired depressions in the roof the pharynx which so far as known to the writer are unique. An especial effort will be made to secure the teeth of this animal in order to elucidate this problem.

ARTIODACTYLA.

Elotherium uintense, sp. nov.

Orbits open posteriorly. No inferior projections upon the malars. A preglenoid crest. Premolars 4 or 3.

This species is named *uintense* to emphasize the surprising fact of its discovery in the Uinta Basin or *true Eocene*. It is even older than the period of the true Uinta beds, since it comes from the *Telmatherium cornutum* level and *below* the typical Uinta or *Diplacodon elatus* level.

Measurements of Skull.

	E. uintense.	E. mortoni.
Length condyles to premaxillaries.........	.43 mm.	
Width zygomatic arches.	.384 "	
Height of occiput	.114 "	
Front of orbit to condyles.........	.225 "	.185 mm.
Molar-premolar series	.142 "	
Molars	.07 "	.068 "
Antero-posterior diameter of canines.	.44 "	

Comparison with Leidy's original specimens of *E.* (*Archæotherium*) *mortoni* from the White River (Am. Mus., Nos. 443–4) shows that the *E. uintense* skull was one-fourth larger and much more robust. In *E. mortoni* the sagittal crest is thinner, the supra-orbital plates are narrower, the swelling for the brain upon the outer surface of the cranium is more sharply defined, the face is relatively straighter. In fact, the Miocene type is smaller and less specialized than the Eocene, and the relations are the reverse of what we should have anticipated.

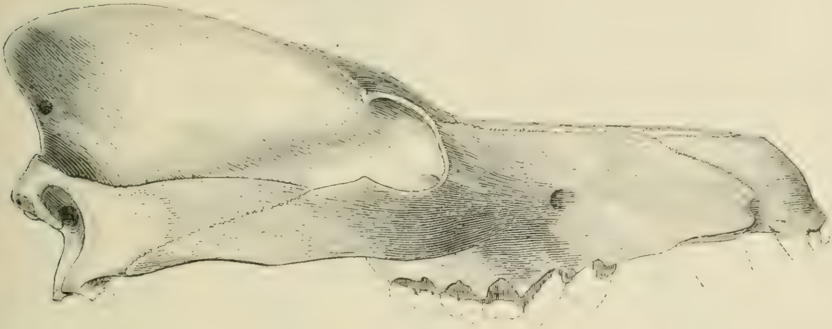

Fig. 16. *Elotherium uintense.* Type. Lateral view of cranium. One-fourth natural size.

It is readily distinguished from *Achænodon robustus* of the Washakie beds by the great elongation of the face and the shortening of the cranium, both of which characters relate it to *Elotherium.* It agrees with *Achænodon* and differs from the oldest types of *Elotherium*, however, in the orbits, which are widely open posteriorly. Unfortunately the premolar formula is uncertain, all the teeth are broken off and it is not possible to determine whether both $P^{\underline{1}}$ and $P^{\underline{2}}$ were present; there was either one single-rooted followed by one two-rooted tooth, or there were two one-rooted teeth here. It seems most probable that there were only three premolars.

The three incisors increased in size laterally, the $I^{\underline{3}}$ being much the largest. The canine tusks were very powerful. The molars, so far as preserved, resemble those of *Achænodon robustus.*

The premaxillaries exhibit a wide contact with the nasals. The nasals are very long, narrow and indented anteriorly; they extend posteriorly to a point opposite the middle of the orbits. The lachrymals are extensively exposed upon the face. The infraorbital foramina are nearer the orbits than in *Achænodon.* The frontals form a very broad, centrally depressed, plate over the

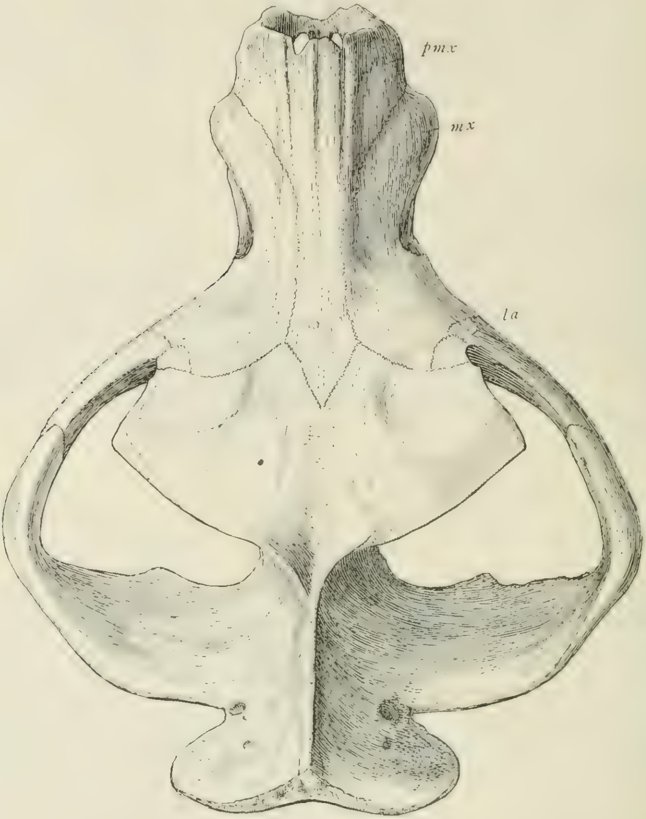

Fig. 17. *Elotherium uintense.* Superior view of cranium.

orbits, overhanging but leaving them widely open; the orbits are much larger than in *A. robustus.* The frontals converge suddenly into the rather short, very sharp and high sagittal crest. The brain-case is very small. The occiput is high and expands fan-like superiorly as in *Elotherium.* The zygomatic arches are slender in vertical diameter and lack the downward malar plates; as shown in top view they diverge or arch sharply outwards. As in *Achænodon* the glenoid fossa is deeply depressed and there is a prominent preglenoid crest. The palatal surface displays the posterior nares opening behind the last molar; the remains of a deep pterygoid fossa ; a very broad glenoid fossa ; a short wedge-shaped basi-cranial series (basi-occipital and sphenoid, pre-sphenoid).

The collection embraces a complete artiodactyl hind limb (No. 1820), including a femur, tibia, astragalus and calcaneum, cuboid and a metatarsal. The total length is 90 cm. or 35½ inches. In comparison with that of *Elotherium* the femur is very short, and there were apparently *four* metatarsals, as indicated by facets upon the median pair. If this limb is related to the above skull it would distinguish it as a new generic type which might be named *Protelotherium*, characterized by four digits in the pes.

Achænodon insolens *Cope.*

It is interesting to find this species, which is characteristic of the Washakie, upon the same level as the *Elotherium.* It is represented by a lower jaw (No. 1825) which corresponds closely with Cope's type.[1] The crown of the teeth are crushed and broken. There is also a portion of a lower jaw (No. 1819) containing the fourth deciduous premolar and an unworn first molar.

The smaller selenodont Artiodactyla are represented by lower jaws and teeth provisionally referred to *Leptotragulus* and *Protoreodon* (Nos. 1800–1818, 1826–1826*a*), but they add nothing to our knowledge of these selenodonts.

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[1] Tertiary Vertebrata, p. 433, pl. 57.

Article III. — ON THE SPECIES OF THE GENUS REITHRODONTOMYS.

By J. A. Allen.

Introductory Note.

The American Museum of Natural History has recently acquired a large number of specimens of the genus *Reithrodontomys*. In attempting to determine them it was found necessary to consider the status of several obscurely known species, particularly the *Reithrodon montanus* and *R. megalotis* of Baird. The original purpose of the present paper was to settle, if possible, the character and relationships of these species, and to record several apparently new forms of the genus, the material at hand being too limited for a detailed revision of the group. The paper was originally prepared on these lines, and on the basis of the specimens belonging to the Museum collection.

After the first draft was practically completed, Dr. C. Hart Merriam, Chief of the Division of Ornithology and Mammalogy of the United States Department of Agriculture, hearing of my work on the group, most generously and without solicitation, placed in my hands for use in this connection all of the United States specimens of this genus belonging to the collection of the Department of Agriculture, collected under his direction, and also those contained in his own collection. These number altogether about 700 specimens, representing nearly the whole United States range of the genus, so that the total number of specimens available for study is not far from 925.[1] This large amount of material throws much light upon the geographic distribution of the genus, and the manner of its representation over the diverse climatic areas embraced within its range. It is, however, insufficient for a final revision of the subject, so that the conclusions here presented must be considered as tentative, and the paper as merely a contribution toward a better knowledge of the group.

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[1] Besides the Museum Collection and the specimens furnished by Dr. Merriam, I am indebted to Prof. L. L. Dyche, of the University of Kansas, for a series of nearly 40 specimens from the vicinity of Lawrence, Kansas, and to Mr. Gerrit S. Miller, Jr., of Peterboro, N. Y., for small series from central Kansas and northeastern Colorado. I am also indebted to Mr. F. W. True, Curator of Mammals in the United States National Museum, for kindly sending me the type and only known specimen of *Reithrodon montanus* Baird, and also for other historic material mentioned *passim* in the present paper.

HISTORICAL SUMMARY.

The history of the group is, in brief, as follows: In the days of Audubon and Bachman the genus was known only from the vicinity of Charleston, South Carolina, and Liberty County, Georgia. The first species commonly referred to this genus was described by Audubon and Bachman in 1841, under the name *Mus humulis* (changed by them to *humilis* in 1851). Whether this species is correctly referable here, or is even certainly determinable, will be considered later. In the following year the same authors redescribed their *Mus humulis*, and added *Mus lecontii* and *Mus carolinensis*. The pertinency of *Mus lecontii* to what is now recognized as *Reithrodontomys* is beyond question, and it is the first name that can be unequivocally applied to the south Atlantic coast form of the genus. *Mus carolinensis* has never been certainly identified, having proved a stumbling block to all subsequent writers on the group. The probabilities are that it was based on an immature example of *Peromyscus*[1] (late *Sitomys*, late *Vesperimus*, = *Hesperomys* of earlier writers), probably *P. leucopus*[2] *gossypinus*, and not at all referable to *Reithrodontomys*. (See more at length on these points beyond.)

In 1853 John Leconte referred *Mus humulis* and *Mus carolinensis* to *Hesperomys*, and *Mus lecontii* (for the first time) to the genus *Reithrodon*, at the same time claiming personal acquaintance with each.

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[1] *Cf.* Thomas, Ann. and Mag. Nat. Hist. (6), XV, Feb , 1895, p. 192.

[2] In June, 1894, I discussed (this Bulletin, III, pp. 294–7) the question of *americanus* Kerr (1792) vs. *leucopus* Rafinesque (1818) raised previously by Dr. Coues, but left by him unsettled, owing to his inability to consult Kerr's work. I was formerly familiar with Kerr's work (Animal Kingdom, etc., 1792), and presumed that a transcript of Kerr's description of his *Mus agrarius americanus* would decide all doubts in the matter. The work not being in any library in New York City, I sent to a friend in Boston for an exact copy of the passage in question. This settled beyond doubt the pertinency of Kerr's name *americanus* to the White-footed Mouse of the northeastern United States, usually known previously as *leucopus* Rafinesque, whereupon (l. c.) I adopted Kerr's name. Mr. Oldfield Thomas, on the authority of Mr. Gerrit S. Miller, Jr., has recently stated (Ann. and Mag. Nat. Hist., Feb. 1894, p. 192) that the name *americanus* is preoccupied by a *Mus americanus* occurring four pages earlier in the same work. Through the kindness of my friend Mr. Samuel Henshaw, Secretary of the Boston Society of Natural History, I have in hand the copy of Kerr's work belonging to the Society, from which it appears that Mr. Miller's statement is well founded. The *Mus americanus* Kerr (l.c., p. 227) is not identifiable, but probably relates primarily to some introduced species of *Mus*, though conjectured by Kerr to be probably the Rat referred to by Kalm as living "among stones and clefts of rocks in the Blue Mountains of Virginia." In any case the name *americanus* is untenable for any form of the White-footed Mouse.

The next important reference to the group is by the late Professor Baird, who, in 1855, described a second species as *Reithrodon montanus*, based on a single specimen from the mountains of Colorado (exact locality unknown). In 1857 the same writer treated the group monographically, describing as new *Reithrodron megalotis* from near San Luis Springs, Sonora, and *R. longicauda* from Petaluma, California, and recognizing four species as valid (the three described by himself and the old *Mus humulis* of Audubon and Bachman), and a fifth (*R. carolinensis* ex Aud. & Bach.) provisionally.

In 1860 De Saussure added, from the mountains of Vera Cruz, Mexico, still another, under the name *R. mexicanus*, and in 1861 described a second, under the name *R. sumichrasti*, also from Mexico.

The next important original work on the group is Coues's revision of the genus in 1874, and his more extended monograph of the group in 1877. The genus *Reithrodon* is here shown to be exclusively South American, and for the North American species heretofore referred to *Reithrodon* be proposed the generic name *Ochetodon*. The species recognized by Coues in 1874 were (1) *O. humilis* (Aud. & Bach.), to which he referred *R. megalotis* Baird, and provisionally *Mus carolinensis* Aud. & Bach.; (2) *O. longicauda* (Baird); (3) *O. mexicanus* (De Sauss.), to which he referred provisionally specimens from Louisiana, thus for the first time recognizing this type of the genus as occurring in the United States. He also recognized provisionally (4) *O. montanus* (Baird), and (5) *O. sumichrasti*. In the later monograph the same allocations are repeated, except that no reference is made, even in synonymy, to *R. sumichrasti*.

In 1892 Merriam called attention to the fact that the name *Ochetodon* Coues was antedated by one year by the name *Reithrodontomys* Giglioli; upon which showing this latter name quickly became current among North American mammalogists.

In 1893 the present writer revived both *R. megalotis* and *R. montanus* of Baird, the latter, however, with some reservation, and gave the alternative name *R. aztecus* for specimens from northwestern New Mexico provisionally referred to *R. megalotis.* Later the same writer described as a new subspecies *Reithrodontomys mexicanus fulvescens* from Oposura, Sonora.

In 1893 Mr. Rhoads described as a new species *Reithrodontomys pallidus* from Santa Ysabel, San Diego Co., California.

Excluding as of doubtful reference to this group both *Mus carolinensis* and *Mus humulus* of Audubon and Bachman (see beyond), the following nine species and subspecies have been described:

1841.	*Reithrodontomys*	*lecontii* (Aud. and Bach.).
1855.	"	*montanus* (Bd.).
1857.	"	*megalotis* (Bd.).
1857.	"	*longicauda* (Bd.).
1860.	"	*mexicanus* (De Sauss.).
1861.	"	*sumichrasti* (De Sauss.).
1893.	"	*aztecus* Allen (provisional name).
1893.	"	*pallidus* Rhoads.
1894.	"	*mexicanus fulvescens* Allen.

Prior to 1855 the group was known only from the coast region of South Carolina and Georgia. In this year Baird described a species from the "Rocky Mountains, lat. 38°," and in 1857 extended the range of the genus to northern Sonora and California, recording also specimens from St. Louis, Missouri. In 1860 (as above stated) a form was made known from the State of Vera Cruz, Mexico. In 1874 Coues referred to specimens from Louisiana, Kansas, Iowa, Nebraska and Utah, and in 1877 gave the detailed records of his material, which included also localities in California and in southern Mexico additional to those mentioned by Baird.

Alston, in 1880, recorded specimens from Coban and Dueñas in Guatemala. During the last two years the published additional records include San Diego Co., California (Rhoads), Texas (Allen), Florida (Chapman and Rhoads) and Arizona (Allen).

To show the increase in material, as well as in our knowledge of the geographic range of the group, the following may be of interest.

In 1857 Baird's material consisted of 32 specimens, representing 7 localities; 12 of the specimens were from South Carolina and Georgia, and 15 of the remaining twenty from the vicinity of San Francisco, California; in other words, nearly all of Baird's material came from two small areas on opposite sides of the continent. In 1877 Coues recorded 57 specimens, representing 16 localities, the 25 specimens additional to those examined by Baird including 9 from southern Mexico, 3 from Louisiana, 4 from the coast region of central California, 6 from eastern Kansas, 2 from Utah, and 1 each from Iowa and Nebraska.

MATERIAL EXAMINED.

The material on which the present paper is based numbers 920 specimens, representing 166 localities, distributed about as follows: California, 87 localities and 471 specimens; northern Lower California, 4 localities and 8 specimens; Nevada, 7 localities and 66 specimens; Arizona, 3 localities and 25 specimens; northern Sonora, 2 localities and 5 specimens; Utah, 10 localities and 53 specimens; New Mexico, 4 localities and 78 specimens; Colorado, 3 localities and 15 specimens; Nebraska, 8 localities and 27 specimens; Montana and South Dakota, 2 specimens each; Kansas, 6 localities and 53 specimens; Arkansas, 1 locality and 2 specimens; Louisiana, 3 localities and 13 specimens; Texas, 18 localities and 67 specimens; Tamaulipas, Mexico, 2 specimens; Florida, 1 specimen; Riceboro, Georgia, 6 specimens; Raleigh, North Carolina, 61 specimens; Southern Mexico, 2 localities and 2 specimens (Mazatlan and Tehuacan); Costa Rica, 1 locality and 17 specimens.

The material in hand, while so extensive and covering such a wide range of country, is far from sufficient to properly represent the genus throughout its range, large areas where it probably occurs being wholly unrepresented, while other portions of great extent are very inadequately represented, and only small sections of the general habitat with any great degree of fullness—mainly those areas covered by the Biological Surveys carried on by Dr. Merriam under the Department of Agriculture.

GENERAL REMARKS.

Geographical Distribution.—The genus is not as yet known to occur in the Gulf States between Florida and Louisiana; but this region has thus far been too imperfectly explored to render it safe to assume that it is absent from this coast belt, where the conditions are apparently highly favorable to its presence. Neither is it known to occur in the area to the northward between the coast region of the Carolinas and the Mississippi River. With this exception the genus is now known to have a practically continuous distribution from the coast of the Carolinas across the continent to the coast of California, and from the mouth of the Big Horn River in Montana southward to central Costa Rica, including both coasts of Mexico. From St. Louis, Missouri, westward to the Pacific coast the genus is apparently represented almost continuously, the higher altitudes in the mountains being of course excepted. It also occurs across southern Texas, from about the mouth of the Pecos River eastward to the coast.

List of Forms Recognized.—In the present paper fifteen forms are recognized, as given in the following list, which also states the number of specimens of each examined.

1. *Reithrodontomys lecontii* (Aud. & Bach.). Coast region of the South Atlantic States. Specimens examined, 69.
2. *R. merriami*, sp. nov. Coast region of western Louisiana and eastern Texas. Specimens examined, 10.
3. *R. dychei*, sp. nov. Eastern Kansas and southeastern Nebraska, east to St. Louis, Mo. Specimens examined, 51.
4. *R. dychei nebrascensis*, subsp. nov. Colorado east of the Rocky Mountains, western Kansas, and north to southeastern Montana. Specimens examined, 43.
5. *R. montanus* (Baird). Head of San Luis Valley, Colorado. Specimens examined, 1 (type of the species).
6. *R. megalotis* (Baird). Western New Mexico, eastern Arizona, and north to northern Utah. Specimens examined, 126.
7. *R. megalotis deserti*, subsp. nov. Death Valley region of southern Nevada and Inyo Co., California. Specimens examined, 189.
8. *R. longicauda* (Baird). Central California, west of the Sierra Nevada. Specimens examined, 175.

9. *R. longicauda pallidus* (Rhoads). Southern California and northern Lower California. Specimens examined, 157.
10. *R. arizonensis*, sp. nov. Chiricahua Mountains, Arizona. Specimens examined, 5.
11. *R. mexicanus* (De Saussure). Southeastern Mexico.
12. *R. mexicanus intermedius*, subsp. nov. Valley of the Lower Rio Grande and adjoining coast region of Texas and Mexico. Specimens examined, 36.
13. *R. mexicanus aurantius*, subsp. nov. Western Louisiana and eastern Texas. Specimens examined, 34.
14. *R. fulvescens* Allen. Northern Sonora. Specimens examined, 3.
15. *R. costaricensis*, sp. nov. Central Costa Rica. Specimens examined, 17.

These forms present wide extremes as regards size, coloration, size and form of the ear, and ratio of tail length to total length ; but the connecting stages are so minutely graduated that none of these features, or any combinations of them, are serviceable as a basis for a sharp division of the genus into minor groups. Nor do the cranial or dental characters prove any more satisfactory as a basis for minor divisions ; and no attempt is made in the present paper to make use of them for the discrimination of species and subspecies, as on measuring a considerable series of skulls it soon becomes evident that the range of individual variation considerably overlaps the average differences between closely allied forms. The length of the skull varies, in different species, from 18 to 24 mm., but the conformation is practically the same in all the species.

The *average* total length of the animal varies in the different species from about 110 mm. to about 190 mm.; the extremes carry the total range from about 100 to 200 mm. In some species (as shown in the subjoined synopsis) the tail vertebræ form decidedly less than half (from 46 to 48 per cent.) of the total length ; in others they constitute more than half (from 52 to 58 per cent.) of the total length ; in others still the two measurements are practically equal, specimens from the same locality falling either side of the line.

In the smaller, short-tailed South Atlantic and Gulf coast forms the general color above is dusky brown ; the larger short-tailed interior forms are grayish brown with a tinge of fulvous ; the longer-tailed forms (*longicauda* and *mexicanus* groups) are darker and more or less washed with bright fulvous, sometimes approaching golden rufous, while the largest and longest-tailed form of the group is nearly as golden rufous as the Golden Mouse (*Peromyscus aureolus*) of the South Atlantic States.

In *R. megalotis* the ear is very large in comparison with most of the other species, the increase being not only in length, but more especially in breadth, and hence is quite different in form from the narrow and more pointed ear in *R. lecontii*, *R. merriami*, *R. longicauda*, etc. In *R. dychei* the ear is somewhat intermediate in size and form, making in *R. dychei nebrascensis* a decided approach to that of *R. megalotis*.

The following synopsis may aid in the determination of the species and subspecies, and serve to show, to some extent, their mutual relationships.

Synopsis of the Species and Subspecies.[1]

A. Tail vertebræ less than half the total length. Ears small.

- *a*. Size small. Total length, 120; tail vertebræ, 56; ear, 9.5. Above dark brown with a light wash of dark cinnamon brown, generally slightly darker along the median line; below dingy gray, sometimes with a slight wash of yellowish; lateral line usually indistinct or obsolete. . . . . *R. lecontii*.
- *b*. Size less than in the last. Length, 112; tail vertebræ, 52; ear, 8.5. Above darker, prevailing color above dusky brown, with a prominent blackish median area; sides yellowish gray brown, with an indistinct fulvous lateral line; below gray with a slight suffusion of yellowish brown . . . . *R. merriami*.
- *c*. Larger. Length, 130; tail vertebræ, 60; ear, 10. Above fulvous gray lined with black, deeping on the sides to an indistinct fulvous lateral band; below grayish white . . . . *R. dychei*.
- *d*. Slightly larger, and more strongly suffused with fulvous. Length, 135; tail vertebræ, 64; ear, 11 . . . . *L. dychei nebrascensis*.
- *e*. Very small. Length, 102; tail vertebræ, 51; ear, 10. Above pale yellowish gray brown, more yellowish on sides; below dull whitish. *R. montanus*.

B. Tail vertebræ about one-half the total length. Ears large.

- *a*. Size medium. Length, 136; tail vertebræ, 63; ear, 12.5. Above yellowish gray, lined with darker; lower border of sides more fulvous; below white . . . . *R. megalotis*.
- *b*. Resembling the last, but with relatively longer tail. Length, 136; tail vertebræ, 70; ear, 12.5 . . . . *R. megalotis deserti*.

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[1] Measurements in millimeters. Unless otherwise stated, all measurements given in this paper are the collector's measurements from fresh specimens, except those of the ear, which are always from the dry skins. The measurement for the ear is the height from the notch.

C. Tail vertebræ slightly more than half the total length. Ears smaller than in *B.*

a. Size medium. Length, 140; tail vertebræ, 74; ear, 11. Above yellowish brown, lined with blackish, with generally a darker median dorsal area; sides brighter, the lower border forming a prominent bright fulvous lateral line; below clear grayish white, occasionally with a yellowish cast.... ....*R. longicauda.*

b. Slightly larger than the last; coloration paler...*R. longicauda pallidus.*

c. Larger. Length, 150; tail vertebræ, 78. In coloration most resembling *R. longicauda*... ....*R. arizonensis.*

D. Tail vertebræ much more than half the total length.

a. Large. Total length, 150; tail vertebræ, 87; ear, 12.7. Above dull ferrugineous brown, becoming bright orange tawny on lower edge of sides; below white with usually a yellowish cast.....*R. mexicanus.*

b. Larger and colors much paler. Length, 176; tail vertebræ, 99; ear, 12. Above grayish brown with a yellowish wash; sides strong yellowish fulvous; below dull whitish....*R. mexicanus intermedius.*

c. About the size of the last, or slightly smaller; colors much stronger. Length, 168; tail, 94; ear, 11.5. Above strongly yellowish brown, with a blackish median area; sides rich orange rufous; below white with a faint yellowish tinge... ....*R. mexicanus aurantius.*

d. Rather larger than the preceding. Length, 176; tail vertebræ, 100; ear, 11.5. Above pale yellowish gray, lined with black, with a blackish median area; sides light yellowish; below white. *R. fulvescens.*

e. Largest of the genus. Length, 191; tail vertebræ, 114; ear, 12. Above bright ferrugineous brown, finely lined with blackish, but with no distinctly darker median area; sides orange rufous; below white, generally with a slight tinge of yellow . . ..*R. costaricensis.*

DESCRIPTIONS OF THE SPECIES AND SUBSPECIES.

Genus **Reithrodontomys** *Giglioli.*

Mus AUD. & BACH. (1841–51).

Hesperomys WAGNER, Wiegm. Arch. 1843 (2), p. 51 (simply referring Audubon and Bachman's "fünf neue arten" of *Mus* to *Hesperomys*).

Reithrodon LECONTE, Proc. Acad. Nat. Sci. Phila. 1853, pp. 410, 413 (merely refers *Mus lecontii* of Aud. and Bach. to *Reithrodon*: not *Reithrodon* Waterhouse, 1837).

Reithrodon BAIRD, Mam. N. Am. 1857, p. 447 (not of Waterhouse).

"*Reithrodontomys* GIGLIOLI, Richer. intorn. alla Distrib. Geog. Gener. 1873, p. 60." (*Apud* MERRIAM, Proc. Biol. Soc. Wash. VII, 1892, p. 26, footnote.)

Ochetodon COUES, Proc. Acad. Nat. Sci. Phila. 1874, p. 184 (=*Reithrodon* Baird, *nec* Waterhouse.

Reithrodontomys is the only North American genus of Muridæ having grooved upper incisors. In other respects the cranial and dental characters are much as in *Peromyscus.* Externally the species also greatly resemble those of this latter genus, but are generally smaller, except *R. costaricensis*, which has more resemblance externally to some of the smaller species of *Oryzomys*.

I have to regret that Giglioli's work wherein he established the genus *Reithrodontomys* is not accessible to me, and hence take the name on Dr. Merriam's authority, as cited above.

Reithrodontomys lecontii (*Aud. & Bach.*).

Leconte's Harvest Mouse.

? Mus humulis Aud. & Bach. Proc. Acad. Nat. Sci. Phila. I, 1841, p. 97; Journ. Acad. Nat. Sci. Phila. VIII, 1842, p. 300. Vicinity of Charleston, S. C. (Not satisfactorily determinable; probably not *Reithrodontomys*.)

? Mus humilis Aud. & Bach. Quad. N. Am. II, 1851, p. 103. (Habitat extended to vicinity of New York City.)

? H[*esperomys*] *humilis* LeConte, Proc. Acad. Nat. Sci. Phila. 1853, p. 413 (in text).

Reithrodon humilis Baird, Mam. N. Am. 1857, p. 448.

Ochetodon humilis Coues, Proc. Acad. Nat. Sci. Phila. 1874, p. 185; Mon. N. Am. Roden. 1877, p. 123. (The Atlantic coast specimens and references only.)

?? Mus carolinensis Aud. & Bach. Journ. Acad. Nat. Sci. Phila. VIII, 1842, p. 306. "Maritime districts of South Carolina." (Not determinable; probably a young *Peromyscus*.)

?? H[*esperomys*] *carolinensis* LeConte, Proc. Acad. Nat. Sci. Phila. 1853, p. 413 (in text).

?? Reithrodon carolinensis Baird, Mam. N. Am. 1857, p. 452 (from Aud. & Bach.).

Mus lecontii Aud. & Bach. Journ. Acad. Nat. Sci. Phila. VIII, 1842, p. 307. Georgia; Ashapoo, S. C.

Reithrodon lecontei LeConte, Proc. Acad. Nat. Sci. Phila. VI, 1853, p. 413. "*Hab.* In Georgia."—Baird, Rep. U. S. and Mex. Bound. Surv. II, Mamm. 1859, p. 43 (in text).

Reithrodontomys humilis Rhoads, Proc. Acad. Nat. Sci. Phila. 1894, p. 161. (Tarpon Springs, Fla.)—Chapman, Bull. Am. Mus. Nat. Hist. VI, 1894, p. 338. (Enterprise, Fla.)

Adult.—Above ruddy fuscous brown, usually a little darker along the median line of the back, lighter and more fulvous on the sides, forming an ill-defined fulvous border at the junction of the dorsal and ventral areas. Below dingy gray, usually with a tinge of fulvous, particularly over the pectoral region, where there is a tendency to an ill-defined chest-mark. (The plumbeous basal portion of the fur shows more or less through the grayish tips of the hairs, which, as already said, often present a distinct wash of brownish fulvous.) Feet whitish; ears more or less dusky; tail more or less distinctly bicolor, dusky above, grayish white below, thinly haired.

Immature.—Darker and more plumbeous above, with little or none of the brownish wash of the adults; below plumbeous, washed with whitish gray. Very young specimens are much darker and more plumbeous than those nearly full grown.

Measurements.—Tail slightly less than half (about 48 per cent.) of the total length. Length, 120; tail vertebræ, 56; hind foot, 15.5; ear, 9.5. (For measurements of additional specimens see Table I, p. 141.)

Geographic Distribution.—Coast district of South Carolina and Georgia, and southward into Florida (Enterprise, *Chapman;* Tarpon Springs, *Rhoads*).

SPECIMENS EXAMINED.

No. of specimens.	Locality.	Date.	Collector.
7	Riceboro, Ga ..	April 12–14........	V. Bailey & R. J. Thompson.[1]
1	Enterprise, Fla	Feb. 27............	C. L. Brownell.[2]
13	Raleigh, N. C..	Nov. 11–Dec. 15. ..	H. H. and C. S. Brimley.[2]
20	" " .	Nov. 7–Jan. 20....	" " [1]
28	" " .	Dec., Feb., March, April and July. ..	" "
69			

[1] Received from U. S. Dept. Agr. [2] Collection Am. Mus. Nat. Hist.
[3] Received from Dr. C. Hart Merriam.

There is considerable seasonal variation in color and condition of pelage, most adult November and December examples being in short, thin pelage and of a lighter, more chestnut-brownish hue than February and March examples, as shown by the large series from Raleigh, covering the period from Nov. 5 to April 7. Half-grown young differ markedly from the adults in being nearly uniform dark plumbeous.

Messrs. H. H. and C. S. Brimley, in answer to my inquiries as to the distribution of this species, have kindly written me as follows: "The only places in North Carolina from which we have seen specimens are Raleigh and Wolke, in Bertie County, on Albemarle Sound." They further state that Mr. C. S. Brimley collected in 1890 at Greensboro, Alabama, and at Bay St. Louis, Hancock Co., Miss., without meeting with this species. "At Raleigh," they add, "it inhabits the upland fields, and also the edges of marshes, but is never found in woods nor in wet meadows, where *Arvicola riparius* abounds. The few nests that have been found were in damp places in tussocks of grass or rushes. At Raleigh it is one of our commonest mice."

While in general the description of *Mus humulis* Aud. & Bach. applies satisfactorily to the species of *Reithrodontomys* occurring near the coast in South Carolina and Georgia, it is singular and noteworthy that these authors failed to mention the grooved incisors in any of the three descriptions given by them of this species; especially when they so particularly refer to the character of the molars, which they compare with those of *Mus* and *Arvicola*, remarking (Quad. N. Am., II, p. 106) "that there are angular ridges on the enamel by which it [this species] approaches the genus *Arvicola*; it is in fact an intermediate species, but in the aggregate of its characteristics perhaps approaches nearest to *Mus*, where for the present we have concluded to leave it." They also state that they believe "this animal can be traced as far to the northeast as the State of New York, several having been procured in traps on the farms in the vicinity of the city." These statements, taken with the fact that *Mus humulis*, in their 'Descriptions of New Species of Quadrupeds inhabiting North America' (Journ. Acad. Nat. Sci. Phila., VIII, pp. 280-323), is separated from their *Mus carolinensis* and *Mus lecontii* by the intervention of *Mus aureolus* and *Mus michiganensis*, and the further fact that grooved incisors are particularly mentioned in the case of *M. carolinensis* and *M. lecontii*, seem to throw doubt upon the tenability of the name *humulis* for any species of *Reithrodontomys*.

It is further to be noted that Le Conte, in his remarks upon North American Muridæ (Proc. Acad. Nat. Sci. Phila., 1853, p. 410), says that "the Mus Lecontei of Bachman....is a Reithrodon, and neither a Mus nor a Hesperomys." In the same paper (p. 413) he refers both *Mus humulis* and *Mus carolinensis*, with which he says he has long been "well acquainted," to *Hesperomys*, and gives under *Reithrodon* only *R. lecontii*.

It is suggestive also that Baird in 1859 (Mex. Bound. Surv., l. c.) compared his *R. megalotis* with *R. lecontii*, and made no mention of *R. humulis*, the inference from which is obvious, as he had previously considered *lecontii* to be a pure synonym of *humulis*.

The only objection to referring *Mus carolinensis* Aud. & Bach. to "*Hesperomys*," as was done by Le Conte, is the statement that "the upper incisors are slightly grooved;" in *M. lecontii* they are said by the same authors to be "deeply grooved." The distinction here made is noteworthy, especially as the proportions and color of *Mus carolinensis* accord well with those of a young

Peromyscus (=*Sitomys*), and do not coincide with any known form of *Reithrodontomys* from "the maritime districts of South Carolina."

Of the pertinancy here of *Mus lecontii* there is no question.

Reithrodontomys merriami,[1] sp. nov.

MERRIAM'S HARVEST MOUSE.

Similar in general features to *R. lecontii*, but distinctly smaller, with slightly shorter tail, and much darker coloration.

Adult.—Above yellowish gray brown, darker along the middle of the dorsal area, forming a broad blackish band from the shoulders posteriorly; sides more yellowish gray, with a faint pale buffy lateral line. Below whitish gray, with often a faint buffy wash, most pronounced on the breast. Ears small, uniform blackish; feet dingy gray; tail very indistinctly bicolor, blackish above, dusky gray below, thinly haired, the annulations often distinctly visible.

Measurements.—Type No. $\frac{32832}{44853}$, Nat. Mus., ♂ ad., Austin Bayou, near Alvin, Texas, March 15, 1892; Wm. Lloyd. Length, 112; tail vertebræ, 55; hind foot, 16.5; ear, 9.

Nine specimens (U. S. Dept. Agr.) from Austin Bayou, near Alvin, Brazoria Co., Texas, measure as follows: Length, 112 (106–128); tail vertebræ, 52 (45–60); hind foot, 16.2 (15.5–17); ear, 8.5 (8–9); ratio of tail vertebræ to total length, 46.4 (44–49).

Geog. Dist.—Coast district of southwestern Louisiana to Brazoria Co., Texas.

Material Examined.—Austin Bayou, near Alvin, Texas, March 13–17, Wm. Lloyd (U. S. Dept. Agr.), 9 specimens; Lafayette, La., May 22, R. J. Thompson (U. S. Dept. Agr.), 1 specimen. Total, 10 specimens.

I also refer to this species a specimen (alcoholic) recorded by Coues (Mon. N. Am. Roden., p. 126, Table xxxiii, third line from bottom), under *Ochetodon humilis*, from Calcasieu Pass, La., of which he gives the following measurements (here reduced to mm.): Length, 112; tail vertebræ, 56; hind foot, 15.2; ear, 9.4. This (if properly referred) forms the first reference to the occurrence of this species in Louisiana.

Fortunately the Riceboro specimens of *R. lecontii* are strictly comparable, as regards season of capture, with the series from Austin Bayou. The differences in coloration are striking; there is also a quite noteworthy difference in size, and in the ratio of tail vertebræ to total length. The pelage is softer and fuller, and the tail more scantily haired.

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[1] Named for Dr. C. Hart Merriam, Chief of the Division of Ornithology and Mammalogy, U. S. Department of Agriculture.

It needs comparison with no other species thus far known.

Reithrodontomys dychei,[1] sp. nov.

DYCHE'S HARVEST MOUSE.

Ochetodon humilis COUES, Proc. Acad. Nat. Sci. Phila. 1874, p. 185 ; Mon. N. Am. Roden. 1877, p. 123 (Kansas, Missouri, Iowa and Nebraska specimens only).

Somewhat resembling *R. megalotis*, but darker, slightly smaller, and with smaller and more distinctly spotted ears.

Adult.—Above mouse gray, rather conspicuously lined with black, lighter and more fulvous on the sides, with an indistinct pale fulvous lateral line extending from the cheeks to the base of the tail ; sides of the nose, lower edge of the cheeks, throat and whole lower parts whitish, the hairs being plumbeous at base and broadly tipped with white, without any tinge of fulvous on the breast or elsewhere on the ventral area. Ears of medium size for the genus, well rounded apically, moderately well clothed with short grayish-brown hairs on both surfaces. A more or less distinct dusky spot on the outer edge of the ear near the base, and another at the base of the ear internally, both often obsolete in old specimens. Usually a quite noticeable tuft of yellowish-brown hairs in front of the anterior base of ears. Tail well haired, distinctly bicolor, the upper third dusky and the rest whitish or grayish white. Upper surface of all the feet whitish.

Young.—Darker and more mixed with blackish above, with the fulvous lateral line (in middle-aged specimens) more uniformly present and stronger than in adults. The dusky ear spots are more distinct, usually forming rather conspicuous markings.

Measurements.—Type, No. $\frac{10127}{8431}$, Am. Mus., ♀ ad., Lawrence, Kans., Jan. 12, 1894 ; Prof. L. L. Dyche. Length, 133 ; tail vertebræ, 52 ; hind foot, 15.5; ear, 10.

Twenty-four adults from Lawrence, Kans., measure : Length, 130 (119–149) ; tail vertebræ, 60 (51–70) ; hind foot, 16.8 (15.2–18.8) ; ear (from skins), 10 (9.5–10.5) ; ratio of tail vertebræ to total length, 46 (44–49).

Five specimens from Neosho Falls, Kans., measure :[2] Length, 118 (102–123) ; tail vertebræ, 53 (43–58.4) ; hind foot, 16 (14.5–16.3).

The Onaga and Trego series are unfortunately not accompanied by measurements.

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[1] Named for Prof. L. L. Dyche, University of Kansas, Lawrence, Kansas.

[2] Measurements from Coues (Mon. N. Am. Roden., p. 126), reduced to mm.

Geog. Dist.—Eastern Kansas, from about the middle of the State eastward to St. Louis, Mo., and from Neosho County north to eastern Nebraska and southwestern Iowa.

SPECIMENS EXAMINED.

No. of specimens.	Locality.	Date.	Collector.	Whence received.
37	Lawrence, Kan.	Dec. 28–Jan. 18, Mar. 22, Apr. 11–13	Prof. L. L. Dyche	Prof. L. L. Dyche.
2	Neosho Falls, Kan.		Col. N. S. Goss	U. S. Nat. Mus.
9	Onaga, Pottawatomie Co, Kan	Oct. 6, Nov. 17–25, Dec. 2, Feb. 11, Apr. 14	F. F. Crevacœur	U. S. Dept. Agr.
1	St. Louis, Mo.		Dr. Geo. Engelmann	U. S. Nat. Mus.
2	London, Lancaster Co., Nebr.	April 29	Geo. A. Coleman	U. S. Dept. Agr.
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This species is much larger than either *R. merriami* or *R. lecontii*. The pelage is very long, soft and full. In coloration *L. dychei* differs from *R. merriami* in being much paler, with much less black over the dorsal area, more yellowish gray sides, and clear white underparts, with a much more sharply bicolored tail, and spotted ears; from *R. lecontii* in much lighter and wholly different coloration, in much fuller, softer pelage, in its heavily-clothed tail and distinctly spotted ears.

Reithrodontomys dychei is based primarily on the large series from Lawrence, Kansas, received from Prof. L. L. Dyche. I refer also to this species the two specimens (one of them is before me) from St. Louis, Missouri, doubtfully assigned by both Baird and Coues to *R. humilis* (=*lecontii*); also the five specimens (two are before me) recorded by Coues under the same name from Neosho Falls, Kans.; and the single specimens from Burlington Kans., and Buchanan Co., Iowa, similarly recorded by the same author.

The Onaga specimens are very dark and very small; some of them are obviously quite young, and all are apparently more or less immature, which probably explains their small size and dark coloration.

Reithrodontomys dychei nebrascensis, subsp. nov.

NEBRASKA HARVEST MOUSE.

Differs from *R. dychei* in slightly larger size, relatively larger ears, and more strongly fulvous coloration.

Adult.—Above yellowish brown finely lined with blackish tipped hairs, particularly over the median area ; the fulvous brown tint is strongest on the sides and posterior half of the dorsum ; beneath white. Ears indistinctly spotted.

Young.—Above pale buffy gray, faintly lined with dusky hairs ; below white. Ears distinctly spotted. Much lighter colored above than the young of *R. dychei* at corresponding ages.

Measurements.—Type, No. $\frac{18624}{25426}$, Nat. Mus., ♂ ad., Kennedy, Nebr., April 19, 1890 ; Vernon Bailey. Length, 130 ; tail vertebræ, 61 ; hind foot, 18 ; ear (from skin), 11.

Thirteen specimens from Kennedy, Nebr., measure : Length, 135 (126–139); tail vertebræ, 63.6 (59-68) ; hind foot, 17.6 (17–18) ; ear (from skins), 11 ; ratio of tail vertebræ to total length, 45.6 (42–47).

Four adult specimens from Cañon City, Col., measure : Length, 141 (128–153) ; tail vertebræ, 64 (58–68) ; hind foot, 16.3 (16–17) ; ratio of tail vertebræ to total length, 45.4.

Geog. Dist.—Western border of the Plains, from Fremont Co., Col., north to Custer, Mont., and east to central and northeastern Nebraska.

SPECIMENS EXAMINED.

No. of specimens.	Locality.	Date.	Collector.
14	Kennedy, Cherry Co., Nebr.	Apr. 19-25	Vernon Bailey.[1]
1	Cherry Co., Nebr.	June 20	A. B. Baker.[1]
2	Alliance, Boxbutte Co., Nebr.	July 13	Dr. A. K. Fisher.[1]
1	Ewing, Holt Co., Nebr.	May 8	V. Bailey.[1]
3	Callaway, Custer Co., Nebr.	Sept. 13, 14	Geo. A. Coleman.[1]
3	Columbus, Platte Co., Nebr.	Aug. 27–29	" "
1	Kearney, Buffalo Co., Nebr.	Sept. 8	" "
2	Pendennis, Lane Co., Kans.	May 8	W. W. Granger.[2]
1	Trego Co., Kans	Dec. 24[2]	
5	" "	Dec. 9–29[3]	
3	" "	Jan. 24	A. B. Baker.[1]
5	Cañon City, Col.	Oct. 2–6	J. A. Loring.[1]
1	Loveland, Larimer Co., Col.	Oct. 22	C. P. Streator.[1]
8	" " "	Apr. 2–14, Sept. 11.	W. G. Smith.[3]
1	Belle Fourche River, S. Dak.	June 2	Vernon Bailey.[1]
1	Vermillion, S. Dak	Dec. 3	G. S. Agersborg.[4]
1	Custer, Mont.	June 14	J. A. Loring.[1]
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[1] Received from U. S. Dept. Agr.
[2] Collection Am. Mus. Nat. Hist.
[3] Received from Gerrit S. Miller, Jr.
[4] " " Dr. C. Hart Merriam.

This subspecies differs from *R. dychei* in its slightly larger size, slightly larger ears, and very much stronger suffusion of fulvous. In coloration it is parallel to the phase of *Peromyscus* found over the same region, and known as *P. americanus nebrascensis*, as compared with other conspecific forms of the latter group. *R. dychei* and *R. dychei nebrascensis* undoubtedly intergrade, from the nature of their distribution, over the central portions of Kansas and eastern central Nebraska.

This form is based primarily on the series from Kennedy, Nebraska—the only series of which measurements taken from the fresh specimens are available. The Loveland series, however, is quite similar in coloration and apparently in size. One specimen of the latter (No. 495, Coll. G. S. Miller, Jr., April 8) is remarkable for its pallor, having an exceedingly bleached appearance, and especially for the absence of the usual dusky stripe along the upper surface of the tail. Another (No. 65,667, Dept. Agr.) from Belle Fourche River, S. Dak., June 2, is remarkable also for its pale *gray* tint, through, apparently, the fading out of the fulvous tinge so prominent in early spring specimens from other localities. August and September specimens are darker and less fulvous than spring examples.

In coloration, hairiness of the tail, and in general features, this subspecies bears a close resemblance to the *R. megalotis* group, Kennedy specimens finding their exact counterpart in coloration in specimens from Inyo Co., California, and southern Nevada, while specimens of the grayer style are almost indistinguishable in coloration from the phase of the *R. megalotis* group represented in the San Juan region of New Mexico and Utah.

Reithrodontomys montanus (*Baird*).

MOUNTAIN HARVEST MOUSE.

Reithrodon montanus BAIRD, Proc. Acad. Nat. Sci. Phila. 1855, p. 335. "Collected in the vicinity of the Rocky Mountains, lat. 38°;" BAIRD, Mam. N Am. 1857, p. 449. "Rocky Mountains, 39°."

? Ochetodon montanus (sp. proband.) COUES, Mon. N. Am. Roden. 1877, p. 130. (From Baird.)

Reithrodontomys montanus ALLEN, Bull. Am. Mus. Nat. Hist. V, 1893, p. 80. (Based on an examination of the type of the species.)

"Tail very little less than head and body, which barely exceeds two inches. Hind foot, .50. Ears small, the membrane thickened, and with long coarse hairs. Above, brown and pale yellowish gray, much lighter than mouse-color. Outside of ears and flanks, pale yellowish brown, without any rufous. Beneath, dull whitish."—*Baird*, N. Am. Mam., p. 449.

Measurements.—" Nose to occiput, 10 lines; nose to root of tail, 2 in. 2 lines [=51 mm.]; tail, from root to end of hairs, 2 in. [=50.8 mm.]; ears, height posteriorly, 3½ lines [=7.4 mm.]; ears, height internally, above notch, 4 lines [=10.2 mm.]; ....hind foot, from heel to end of claws, 6 lines [=12.7 mm.]; skull, length, 9⅓ lines [=44.5 mm.]; ...."—*Baird*, l. c., p. 450.

Geog. Dist.—Known only from the type, taken in lat. 38° to 39°, in the Rocky Mountains, probably near the upper end of the San Luis Valley in Colorado.

Although the original type of the species is before me, I have preferred, owing to its present deteriorated condition, to copy Baird's excellent description rather than to give a new one. There is nothing, in fact, to be said in amplification of what Baird wrote, the type still remaining unique. There are no specimens in the material before me from any point nearer the type locality than Cañon City, some fifty miles to the eastward, and in a quite different region. The type specimen, as said by Baird, "appears quite adult"; in fact, the teeth are considerably worn, and there are other indications of full maturity. Yet the specimen is not larger than quite immature (one-half to two-thirds grown) examples of *R. megalotis* or *R. dychei*. The very small ears, with the membrane thickened and covered with rather coarse yellowish hairs, the small size of the auditory bullæ and their rather oblique position, and the rather peculiar enamel pattern of the molariform teeth, are features not seen in any other example of the genus I have examined.

In external characters—as the relative length and hairiness of the tail, and in coloration—there is little besides the small thickened ears to distinguish it from immature examples from northern New Mexico, Colorado or Kansas.

The type of *Reithrodon montanus* is No. 13 of the specimens taken by Mr. Kreutzfeldt on Capt. E. G. Beckwith's Expedition from Wesport, Mo., to the Pacific Coast in 1853–4. Only a few specimens of mammals and birds appear to have been collected on this particular expedition, as on careful collation of Baird's famous Vols. VIII and IX of the Pacific R.R. Explorations and Surveys, I find only about a dozen localities mentioned from which specimens are credited to Beckwith's Expedition. The locality of the type in question appears not to have been accurately known even to Professor Baird, who records it as "vicinity of the Rocky Mountains, lat. 38°," in his first description of the species, and later as "Rocky Mountains, 39°." Specimens Nos. 15–18 of Beckwith's Collection are given as from Sewatch Pass, and Nos. 14 and 20–22 as from Coochetopa Pass. The series begins with No. 1, taken at Bent's Fort, on the Arkansas River; No. 3 was from the Greenhorn Mountains; No. 5 from Sangre de Christo Pass, and Nos. 7 and 11 from near Fort Massachusetts. From the itinerary of the expedition (P. R. R. Expl. and Surv., II, pp. 1–128, and particularly pp. 116 and 120–122) it is evident that No. 13, the type of *Reithrodon montanus*, was taken about August 29 or 30 in the upper part of the San Luis Valley. Until this region has been thoroughly explored for 'topotypes' of *R. montanus*, it would be obviously improper to reject this species as unidentifiable or to give the name precedence over *R. megalotis* for the form here recognized under that name.

Reithrodontomys megalotis (*Baird*).

BIG-EARED HARVEST MOUSE.

Reithrodon megalotis BAIRD, Mam. N. Am. 1857, p. 451; Rep. U. S. and Mex. Bound. Surv. II, Mamm. 1859, p. 43. Between Janos, Sonora and San Luis Springs, New Mexico.

Reithrodontomys megalotis ALLEN, Bull. Am. Mus. Nat. Hist. V, 1893, p. 79 (San Juan region of New Mexico and Utah); ALLEN, ibid. VI, 1894, p. 320 (Fairbank, Arizona).

Reithrodontomys aztecus ALLEN, ibid. V, p. 79. La Plata, New Mexico.

Ochetodon humilis COUES, Proc. Acad. Nat. Sci. Phila. 1874, p. 185; Mon. N. Am. Roden. 1877, p. 123. (Only the references to *R. megalotis* Baird.)—ALSTON, Biol. Centr.-Am. Mamm. 1880, p. 151. (The Sonoran references only.)

"Largest of North American species. Head and body from 2.50 to 3.00 inches [=63.5 to 76 mm.]; tail about two-tenths shorter. Hind foot near .70 [=17.8]. Ears large, moderately clothed with hair. Above mouse-gray, lined with darker, and tinged with rusty; on the rump and sides a fulvous wash. Beneath soiled yellowish white."—*Baird*, Mam. N. Am., p. 451.

The above is an excellent description of average adults. Immature specimens are grayer with less of the fulvous wash, and with indistinct blackish ear spots, as in *R. dychei*. Occasionally the fulvous on the back in adults shades on to a reddish tinge. The upper surface of the tail is distinctly darker than the sides and lower surface, well clothed with short hairs, wholly concealing the annuli, except in worn specimens. Feet soiled whitish.

Measurements.—(See Table II, p. 141.) In compiling the table obviously immature specimens were excluded, although a number of 'young adults' are embraced in several of the series, as in those from Aztec and Provo, thus tending to lower the general average.

Geog. Dist.—Northeastern Sonora northward through western New Mexico and eastern Arizona to Northern Utah. The localities given in the following table indicate more in detail the known distribution of the species.

SPECIMENS EXAMINED.

No. of specimens.	Locality.	Date.	Collector.
1	Near San Luis Springs, Sonora.	....	Dr. C. B. Kennerly.[1]
1	Fort Huachuca, Ariz	....	Dr. T. E. Wilcox.[1]
5	Fairbank, Ariz	March 2–14	Price and Condit.[2]
1	St. Thomas, Ariz	Jan. 29	Vernon Bailey.[3]
1	Silver City, N. Mex	Dec. 5	C. P. Streator.[4]
1	Las Vegas, N. Mex	April 6	........[2]
2	Aztec, N. Mex	March 19, 20	C. P. Rowley.[2]
33	“ “	Dec. 5–9	J. A. Loring.[4]
7	La Plata, N. Mex	Mch. 30–Apr. 11.	C. P. Rowley.[2]
34	“ “	Dec. 10–12	J. A. Loring.[4]
1	Riverview, Utah	April 25	C. P. Rowley.[2]
1	Bluff City, Utah	May 18	“ “
4	“ “	Nov. 8, 9	J. A. Loring.[4]
4	Noland's Ranch, S. W. Utah.	Nov. 23	“ “
3	Fairfield, Utah	June 24, 25	Vernon Bailey.[4]
1	Manti, Utah	Dec. 11	........[2]
1	Camp Floyd, Utah	....	C. S. McCarthy.[1]
5	St. George, Utah	Jan. 5	Vernon Bailey.[3]
15	Provo, Utah	Nov. 11–Dec. 15.	“ “
2	Kelton, Utah	Oct. 25	“ “
3	Ogden, Utah	Oct. 1–3	“ “
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[1] Received from U. S. Nat. Mus.
[2] Collection Am. Mus. Nat. Hist.
[3] Received from Dr. C. Hart Merriam.
[4] “ “ U. S. Dept. Agr.

R. megalotis was described from two specimens (Nos. 1039, skin, and 1040, alcoholic, U. S. Nat. Mus.) taken by Dr. C. B. R. Kennerly, between Janos and San Luis Spring, Sonora, near the boundary line of southwestern New Mexico, the former of which is properly to be considered as the type. Of these specimens only the skull of No. 1039 appears to be extant. This specimen, through the kindness of Mr. True, Curator of Mammals in the U. S. National Museum, I have the opportunity to reëxamine[1] in the present connection. This skull, taken in connection with Baird's excellent description of the external characters, appears to leave no question of the propriety of applying the name to the species now so well represented by specimens from New Mexico, Arizona and Utah, among which is a small series from Fairbank, Arizona, a point about one hundred miles northwest from the type locality of the species. The Fairbank specimens are not appreciably different from large series from the San Juan Valley in northwestern New Mexico and southeastern Utah. Specimens from central and northern Utah are so closely similar that I am unable to specify any differences. In a series of 13 specimens from Winslow, Arizona, the tail averages slightly longer than in any of the series from New Mexico and Utah, and on this account has been referred to the next form rather than here.

Reithrodontomys megalotis deserti, subsp. nov.

DESERT HARVEST MOUSE.

Similar in coloration to *R. megalotis*, but with a considerably longer tail. Tail 50 to 52 per cent. of the total length, instead of 46 to 48 per cent., as in *R. megalotis* proper.

Type, $\frac{27720}{39819}$, U. S. Nat. Mus. (Dept. of Agr. Coll.), ♀ ad., Oasis Valley, Nye Co., Nevada, March 16, 1891; F. Stephens.

Measurements.—(See Table III, p. 142.)

Geog. Dist.—Southern Nevada and Inyo Co., California.

Specimens Examined.—(See next page.)

In coloration, general size, size of the ears, hairiness of the tail, and in other external features, there is very little difference between examples from the Death Valley region of California and adjoining portions of Nevada and specimens from northern Utah and thence southward to western New Mexico and eastern Arizona. The fulvous suffusion of the dorsal surface is possibly a little stronger and more of a brownish cast than in the Death Valley specimens, but the average difference in this respect is so slight as to be thoroughly masked by the wide range of individual and seasonal variation shown by any of the larger series, and

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[1] See this Bulletin, V, 1893, p. 79.

SPECIMENS EXAMINED.[1]

No. of specimens.	Locality.	Date.	Collector.
13	Winslow, Ariz.	May 1–5.	C. P. Streator.
2	Grapevine Mts., Esmeralda Co., Nev.	Mch. 22 & June 9	F. Stephens & E. W. Nelson.
26	Ash Meadows, Nye Co., Nev.	March 4–12.	Fisher, Stephens, Nelson & Palmer
16	Oasis Valley, Nye Co, Nev.	March 15–18.	F. Stephens.
1	Panaca, Lincoln Co, Nev.	May 20.	Vernon Bailey.
12	Pahrump Valley, Lincoln Co., Nev.	Feb. 17–Mch. 16,	E. W. Nelson.
4	Pahranagat Valley, Lincoln Co., Nev.	May 24–26.	Vernon Bailey.
5	Vegas Valley, Lincoln Co, Nev.	March 11–16.	“
30	Lone Pine, Inyo Co., Cal	Dec. 5-17 and June 7-9	Bailey, Nelson and Fisher.
5	Keeler, Inyo Co., Cal.	Dec. 8–10.	E. W. Nelson.
6	Owens Valley, Inyo Co., Cal.	June 26–July 10,	F. Stephens.
1	Emigrant Springs, Inyo Co., Cal.	April 15.	“
1	Twelve Mile Spring, Inyo Co., Cal.	Feb. 11.	E. W. Nelson.
5	Grapevine Ranch, Inyo Co., Cal	April 2–4.	F. Stephens.
20	Olancha, Owens Lake, Inyo Co., Cal.	May 16–22.	“
2	Ash Creek, Owens Lake, Inyo Co., Cal.	May 30.	“
10	Cartago, Owens Lake, Inyo Co., Cal.	June 4–11	“
9	Panamint Valley, Inyo Co., Cal.	Jan. 8–10.	Bailey and Fisher.
6	Panamint Mts., Inyo Co., Cal	April 5–May 27.	E. W. Nelson.
1	Shepherd Cañon, Inyo Co., Cal.	Jan. 3.	“
3	Resting Springs, Inyo Co., Cal.	Feb. 9–18	Fisher and Nelson.
3	Saratoga Springs, Inyo Co., Cal.	Feb. 1, 2.	Vernon Bailey.
5	Death Valley, Inyo Co., Cal.	Feb. 3 & June 20,	Fisher and Bailey.
1	Argus Mts., Inyo Co., Cal.	April 25.	F. Stephens.
1	Furnace Creek, Inyo Co., Cal.	April 9.	“
1	Bishop Creek, Inyo Co., Cal.	August 9.	“
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[1] All received from U. S. Dept. Agr.

therefore is scarcely serviceable as a diagnostic feature. On the other hand, the difference in the relative length of the tail seems too important to be ignored, amounting to at least 4 per cent. Thus in *R. megalotis* the tail is decidedly less than half the total length, while in *R. megalotis deserti* it equals or exceeds one-half the total length. In a series of about 100 examples of *R. megalotis* proper it is exceedingly rare to find one in which the tail vertebræ equal one-half the total length, while in a still larger series of *deserti* specimens rarely occur in which the tail length does not equal or slightly exceed half the total length. In the average there is a difference of 4 per cent. in the relative length of the tail in the two forms, with only an exceptional overlapping by individual extremes. These differences are well shown in the tables of averages and extremes of the two forms (see pp. 141, 142).

A small series of five specimens from the Panamint Mountains, Inyo Co., California, seems to offer an exception to the general rule obtaining in the series from neighboring localities, in this series the tail dropping down to the length proper to *R. megalotis.* Whether a larger series might not alter this ratio, or whether the series indicates a local short tailed form within the range of the long tailed style cannot at present be determined.

The series from Winslow, central Arizona, agrees so well in tail-length with the *deserti* group that it is provisionally referred here, although on geographical grounds it would seem more naturally referable to true *megalotis.* The coloration is also slightly different from that shown in series from other points, so that possibly the Winslow series may indicate the presence of a slightly differentiated local phase in central Arizona.

There is quite a wide range of variation in the coloration of the upper parts in specimens from the same locality, strictly comparable as to sex, age and season, specimens varying from pale grayish brown, washed with fulvous to much darker grayish brown washed with dark cinnamon.

Reithrodontomys longicauda (*Baird*).

SONOMA HARVEST MOUSE.

Reithrodon longicauda BAIRD, Mam. N. Am. 1857, p. 451. Petaluma, Sonoma Co., California.

Ochetodon longicauda COUES, Proc. Acad. Nat. Sci. Phila. 1874, p. 186; Mon. N. Am. Roden. 1877, p. 126.

Adult.—Above yellowish brown, heavily lined with black, the profusion of the intermixed black hairs usually forming a distinctly blackish area along the median line of the back; sides paler, less blackish and more yellowish, with a rather broad fulvous lateral line, extending from the cheeks to the rump, varying in intensity and distinctness in different individuals. Below dingy grayish white, often with a tinge of yellow, and sometimes with a more or less distinct fulvous patch on the breast. Ears dusky, thinly clothed with yellowish brown hairs, with, as in nearly all the forms of the genus, a tuft of rusty brown hairs at the anterior base. Feet soiled white; tail rather sharply bicolor, dusky above, grayish white below, covered with short hairs, only partly concealing the annuli.

Young.—Above nearly uniform mouse color; below plumbeous, washed with gray. Ear with an elongated dusky spot near the base of the outer edge, which is usually obsolete in adults.

Young adults are duller and more uniformly colored above than adults, and generally lack the blackish median area along the back.

Summer and early autumn specimens are usually paler, with less black, than winter and early spring specimens.

Measurements.—Average and extremes of 6 specimens from Glen Ellen, Sonoma Co., Cal.: Length, 136.5 (129–144); tail vertebræ, 72 (68–79); hind foot, 17 (16–18); ear (from skins), 11.2 (10.5–12); ratio of tail vertebræ to total length, 52.2 (50–54.8). This is about an average series, from near the type locality. Measurements of other series are given in Table IV (p. 142). The tail varies from 50 to 56 per cent. of the total length, averaging about 53 per cent.

SPECIMENS EXAMINED.

No. of specimens.	Locality.	Date.	Collector.
4	Tehama, Tehama Co., Cal.	Dec. 30, 31	C. P. Streator.[1]
6	Leesville, Colusa Co., Cal	June 6-8	F. Stephens.[1]
3	Lower Lake, Lake Co., Cal.	April 23–25	“
10	Glen Ellen, Sonoma Co., Cal.	Jan. 10–21	C. P. Streator.[1]
3	Fairfield, Solano Co., Cal.	Feb. 4–6.	“ “
2	Novato, Marin Co., Cal.	Jan. 28	“ “
5	Nicasio, Marin Co., Cal	March 6–9.	C. A. Allen.[2]
5	“ “ “	Feb. 17–23.	C. P. Streator.[1]
1	Jackson, Amador Co., Cal.	March 24	“ “
1	Martinez, Contra Costa Co., Cal.	April 13.	F. Stephens.[1]
20	Walnut Creek, Contra Costa Co., “	Feb. 14–20.	C. P. Streator.[1]
10	Tracy, San Joaquin Co., Cal.	Jan. 9, 10.	J. E. McLellan.[1]
3	Berkeley, Alameda Co., Cal	Feb. 27–29	C. P. Streator,[1]
14	San Mateo, San Mateo Co., Cal.	Feb. 5–9	J. E. McLellan.[1]
11	Portola, Santa Cruz Co., Cal.	March 20-28.	R. L. Wilbur.[3]
45	La Honda, “ “	Dec. 24–Jan. 1.	Price & Wilbur.[3]
16	Monterey, Monterey Co., Cal	Sept. 30–Oct. 2.	Vernon Bailey.[1]
1	San Jacinto, Monterey Co., Cal.	Oct. 2	F. Stephens.[1]
2	Pacific Grove, “ “	Oct. 6	J. H. Oliver.[1]
1	Posts, “ “	March 11	J. E. McLellan.[1]
7	Sur, “ “	March 4–13.	“ “
5	Jamesburg, “ “	March 18–21	“ “
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[1] Received from U. S. Dept. Agr.
[2] Collection Am. Mus. Nat. Hist.
[3] Received from W. W. Price.

Geog. Dist.—California, west of the Sierra Nevada, from the coast region of Monterey County north to Mendocino County, and in the interior from San Joaquin County north to Tehama County. Probably further south, irregularly, in the Coast and San Bernardino ranges of mountains.

Specimens Examined, 175, as shown by the foregoing table.

Fourteen of the 15 specimens on which Baird based his *R. longicauda* were from Petaluma, and the other from San Francisco, California. As shown above, the region of the type locality is well represented in the present material. Baird's measurements, based on alcoholics, fall much under the average, taken from fresh specimens, due probably to the presence of a rather large proportion of more or less immature examples.

The table of measurements (see p. 142) apparently indicates more or less variation in size with locality, but this is more apparent than real, since in the series giving large measurements all of the specimens are practically adult, while those giving smaller averages contain examples that are not fully grown, although as a rule, obviously immature specimens were thrown out in making up the table.

Reithrodontomys longicauda pallidus (*Rhoads*).

SAN DIEGO HARVEST MOUSE.

Reithrodontomys pallidus RHOADS, Am. Nat. XXVII, Sept. 1893, p. 835. Santa Ysabel, San Jacinto Mts., San Diego Co. Cal. (Type in Am. Mus. Nat. Hist.)

Paler and slightly larger than *R. longicauda*.

Adult.—Above grayer, less fulvous, and less varied with blackish than *R. longicauda*. Averages about 8 to 10 mm. longer, with slightly larger ears, as shown by the measurements (Table V), in comparison with the table for *R. longicauda* (Table IV).

Measurements.—(See Table V, p. 143.)

Geog. Dist.—Southern California and northern Lower California, from Monterey County on the Coast and Merced County in the interior southward. Appears to develop slightly differentiated local phases in some of the southern mountain ranges.

Specimens Examined.—(See next page.)

Respecting Mr. Rhoads's *R. pallidus*, I find myself greatly embarrassed as to which of three courses to pursue in the matter,

SPECIMENS EXAMINED.

No. of specimens.	Locality.	Date.	Collector.
2	Boulder Creek, Monterey Co., Cal.	Oct. 15	Vernon Bailey.[1]
1	Bear Valley, San Benito Co., Cal.	June 22	J. E. McLellan.[1]
1	Los Baños, Merced Co., Cal	Jan. 5	"
3	Fresno, Fresno Co., Cal	March 3–6	C. P. Streator.[1]
1	Three Rivers, Tulare Co., Cal.	July 21	T. S. Palmer.[1]
1	Lemoore, Kings Co., Cal.	Feb. 27	J. E. McLellan.[1]
1	Kern River, Kern Co., Cal.	July 1	Vernon Bailey.[1]
7	San Emigdio Cañon, Kern Co., Cal.	Oct. 18, 19	E. W. Nelson.[1]
1	Tehachapi, Kern Co., Cal.	June 9	J. E McLellan.[1]
1	Adobe Station, "	Oct. 13	E. W. Nelson.[1]
1	Old Fort Tejon, "	July 8	T. S. Palmer.[1]
5	San Simeon, San Luis Obispo Co., Cal.	Nov. 22	E. W. Nelson.[1]
5	San Luis Obispo, San Luis Obispo Co., Cal.	Nov. 26, 27	"
3	Pozo, San Luis Obispo Co., Cal.	Oct. 29	"
2	Morro, " "	Nov. 10	"
2	Paso Robles, " "	March 12, 13	F. Stephens.[1]
4	Jolon, " "	March 31–April 2,	J. E. McLellan.[1]
3	Santa Maria, " "	Dec. 2	E. W. Nelson.[1]
5	Gaviote Pass, Santa Barbara Co., Cal.	Dec. 9–12	"
4	Santa Inyez Mission, Santa Barbara Co., Cal	Dec. 4	"
2	Santa Barbara, Santa Barbara Co., Cal.	Dec. 12	F. Stephens.[1]
2	Carpentaria, Santa Barbara Co., Cal.	Dec. 19	E. W. Nelson.[1]
2	Los Olivos, Santa Barbara Co., Cal.	March 6	F. Stephens.[1]
4	Hueneme, Ventura Co., Cal.	Feb. 25	"
3	Ventura River, "	Dec. 21–23	E. W. Nelson.[1]
3	Montalva, "	Feb. 28	F. Stephens.[1]
17	Sta. Paula, "	Dec. 29–Jan. 4	E. W. Nelson.[1]
4	Burbank, Los Angeles Co., Cal.	March 10–12	C. P. Streator.[1]
7	San Fernando, "	March 18–22	"
4	Santa Monica, "	Feb. 16–18	F. Stephens.[1]
1	Calabasas, "	Feb. 2	"
2	Las Virginus Creek, "	Feb. 22	"
3	Rêche Cañon, San Bernardino Co., Cal	Sept. 22–24	"
2	San Bernardino Peak, San Bernardino Co., Cal	Oct. 2	J. E. McLellan[1]
2	Elsinore, Riverside Co., Cal.	Nov. 2	F. Stephens.[1]
1	Temascal, "	Nov. 1	"
2	Radec, "	Feb. 3–5	"
1	Riverside, "	Sept. 20	"
1	San Marcos, San Diego Co., Cal.	Nov. 11	F. W. Koch.[1]
1	Dulzura, "	Oct. 18	C. H. Marsh.[1]
1	Twin Oaks, "	June 4	F. W. Koch.[1]
3	San Jacinto Mts., "	June 15–27	"
1	San Jacinto, "	Oct. 2	F. Stephens.[1]

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[1] Received from U. S. Dept. Agr.

SPECIMENS EXAMINED.—*Continued.*

No. of speci-mens.	Locality.	Date.	Collector.
18	Santa Ysabel, San Diego Co., Cal.	Dec.–March.	F. Stephens.[2]
2	Jacumba, “	May 2..........	F. X. Holzner.[2]
1	Cameron's Ranch, “	June 6..........	“
3	Jumal Creek, “	July 6–8........	“
3	Coast Mts., “	July 14.........	“
1	Seven Wells, Lower Cal	April 16	“
2	Gardiner's Lagoon, Lower Cal...	April 17–26......	“
1	Nashaguerro Valley, “ ...	June 8	“
4	San Cedros, “ ...	June 29–July 3...	“
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[2] Collection Am. Mus. Nat. Hist.

namely: (1) To refer *R. pallidus* to *R. longicauda* as a pure synonym of the latter; (2) to treat *R. pallidus* as one of several local phases of *R. longicauda;* (3) to let the name stand in a subspecific sense for a generally dispersed paler southern form of *R. longicauda*, as opposed to true *longicauda* of the region from about Monterey and Merced Counties northward. Through lack of material for properly working out the problem I have provisionally adopted the latter course.

There is rather less difference between the representatives of the *longicauda* group from the plains and open valleys of southern California, and those from Sonoma and adjoining counties, than would be anticipated, considering the very diverse physical conditions of the two regions. Yet that the former are reasonably separable from the latter as a subspecies is fairly evident; but when we take into account those inhabiting the more or less isolated wooded mountainous districts of the southern counties, as the San Jacinto, Santa Ynez, and other ranges, the matter is much complicated. With no questions of synonomy in the way, I should not hesitate to name the form inhabiting the arid plains and valley districts of the southern half of the State, for which the name *pallidus* of Rhoads is unfortunately not strictly pertinent, being based on a dark, rather small mountain phase from the San Jacinto Mountains. His description was based apparently on three specimens, one of which (evidently immature) was from "San Bernardino," while the other two (borrowed from this Museum) were from Santa Ysabel. One of the latter (No.

$\frac{3289}{2568}$, ♀ ad.) he selected for his type, "owing," he says, "to the more typical character" of the specimen; adding: "Duplicates of *pallidus* from the San Bernardino Valley southward, will probably confirm its good specific characters." In reality the San Bernardino animal is very different from the form he has designated as his type. Indeed, this type specimen proves to be the darkest example in a series of eighteen (recently received by this Museum) from the original type locality, and which as a series seem to be very doubtfully separable from true *longicauda*, from which they are much less different than from the form so well represented in the material before me from the southern border of San Diego County, and various other points further northward.

Should the form from Santa Ysabel (San Jacinto Mountains) prove entitled to recognition, it should of course bear the (unfortunately rather inappropriate) name *pallidus*, thus leaving the real pallid form of southern California eligible for a new subspecific designation.

Reithrodontomys arizonensis, sp. nov.

Chiricahua Harvest Mouse.

Reithrodontomys longicauda Allen, Bull. Am. Mus. Nat. Hist. VI, 1894, p. 320 (in text).

Adult.—Above brown, lined with black, and washed with reddish fulvous, including the whole top of the head; middle of back slightly darker than rest of the dorsal surface; fulvous of sides strongly golden, forming a prominent broad lateral line, extending from the cheeks to the tail. Below grayish white, the fur plumbeous at base, with a rust-colored patch on the breast. Ears blackish, particularly along the outer border above; feet soiled white; tail nearly naked, indistinctly bicolor, dusky on the dorsal surface, gray below.

Young.—Grayish brown above, ashy plumbeous below. Tail sparsely haired, the hairs only partly concealing the annulations.

Measurements.—Type: Length, 152; tail vertebræ, 78; hind foot, 18; ear, 13; ratio of tail vertebræ to total length, 51.3. Four adults measure: Length, 149 (145–152); tail vertebræ, 78 (74–80); hind foot, 17 (16–18); ear, 13 (12.5–14).

Type, No. $\frac{8843}{7142}$, Am. Mus., ♀ ad., Chiricahua Mountains, Arizona, July 8, 1894; B. C. Condit (Price Collection).

Specimens Examined.—Five examples, four adult and one immature, collected on Rock Creek in the Chiricahua Mountains, Cochise Co., Arizona (altitude about 8000 feet), July 7–9, 1894, by B. C. Condit.

This species finds its nearest relative in *R. longicauda* of California, from which it differs in more reddish coloration, particularly on the head. In size it is also considerably above the average of *R. longicauda.* Geographically the two forms are widely separated, so far as known *R. longicauda* not being found east of the San Jacinto Mountains in southern California.

Reithrodontomys mexicanus (*De Saussure*).

? *Mus tazamaca* Gray, P. Z. S. 1843, p. 79 (*apud* Alston). Coban, Guatemala. Nomen nudum.

Reithrodon mexicanus De Saussure, Rev. et Mag. de Zool. 1860, p. 109, pl. ix, fig. 1 (*Hesperomys mexicanus* on plate). "Habite les montagnes de la province de Véra-Cruz."—? Alston, P. Z. S. 1876, p. 756=*Mus tazamaca* Gray.

Reithrodon sumichrasti De Saussure, ibid. 1861, p. 3. "Mexican tellus."

Ochetodon mexicanus Coues, Proc. Acad. Nat. Sci. Phila. 1874, p. 186; Mon. N. Am. Roden. 1877, p. 128 (exclusive of Louisiana specimens).—Alston, Biol. Cent. Am. Mamm. 1880, p. 151.

Description.—"La couleur du pelage est un brun-fauve, qui devient tout à fait fauve sur les côtés, ou même fauve-orangé. Plus bas le fauve devient pâle, là où il est en contact avec le blanc du ventre. Les lèvres, le bas des joues, le menton, la gorge et toutes les parties inférieures sont d'un blanc assez pur, un peu lavé de fauve par places, surtout à la poitrine et à la gorge....Les poils sont d'un gris ardoise, avec le bout seulement roux ou blanc. Les oreilles sont brunes ;....Les pieds antérieurs sont blancs, sauf en dessus, jusqú'a l'origine des doigts, où ils sont gris. Les pieds postérieurs sont obscurs, avec les orteils blancs. La queue est noirâtre, écailleuse, unicolore et garnie de poils gris assez obscurs ; elle est surtout poilue vers le bout ; á sa base, les poils sont rares et trés-courts ; mais ils deviennent plus longs vers son extrémeté."—*De Saussure*, l. c.

Measurements.—"Longueur du corps et de la tête, 0^m, 068 ; de la queue, 0^m. 092 ; du pied postérieur, 0^m, 019.—Hauteur des oreilles à la face externe, 0^m, 011 ;—largeur des oreilles, 0^m, 010."—*De Saussure*, l. c.

Coues (l. c., p. 130) gives the measurements of 9 specimens from the State of Vera Cruz (3 skins from Tehuacan, and 6 alcoholics from Orizaba, Cordoba, and Mirador), which, reduced to millimetres, are, for the 6 alcoholics, as follows: Length, 150 (141–157); tail vertebræ, 87 (82.5–91); hind foot, 19.5 (18.3–20.5); ear, 12.7 (11.5–14.5); ratio of tail vertebræ to total length, 58 (57–60). One of the skins (No. 7007*a*, U. S. Nat. Mus.) is slightly larger, giving the following: Length, 171.5; tail vertebræ, 95; hind foot, 20.3; ear, 12.7; ratio of tail to total length, 55.5—but this skin is probably overstuffed.

The only specimen of this species before me is No. 7007*a*, U. S. Nat. Mus., which was compared with De Saussure's type (borowed by Dr. Merriam some years ago from the Geneva Museum) by Dr. Merriam, Mr. True and myself, Nov. 24, 1890, with which it was found to agree. It was collected by Mr. F. Sumichrast at Tehuacan, State of Vera Cruz, Mexico, a locality which comes within the habitat of the species as given by De Saussure—"Habite les montagnes de la province de Véra-Cruz." The measurements quoted above from Coues agree very closely with those given by De Saussure, the average length of six specimens exactly agreeing with that given by De Saussure.

Reithrodontomys mexicanus intermedius, subsp. nov.

RIO GRANDE HARVEST MOUSE.

Similar in size and proportions to *R. mexicanus*, but very much paler.

Adult.—Above grayish brown, washed with pale yellowish, varied slightly with darker hairs over the median area of the back, lighter on the sides, and becoming more yellow along the lateral line. Below white, the hairs plumbeous at base and broadly tipped with white. Ears brown, darker towards the margin on the outer surface, thinly haired, the very short hairs on the apical third of the inner surface rufous. Feet soiled white. Tail dusky, nearly unicolor (the lower surface a little lighter than the upper), nearly naked, the annuli nearly always conspicuously visible.

Young.—Paler and more nearly uniform above, with less of the pale fulvous wash; beneath with less white to the tips of the hairs; the dusky ear mark more conspicuous.

Measurements.—Type, ♀ ad.: Length, 194; tail vertebræ, 108; hind foot, 21; ear (from skin), 13; ratio of tail vertebræ to total length, 54.6.

Fifteen specimens from Brownsville, Texas, measure: Length, 178 (160–198); tail vertebræ, 98.7 (90-110); hind foot, 20 (19-21); ear (from skin), 12 (11–13); ratio of tail vertebræ to total length, 55.5 (53–58.5).

Type, No. $\frac{4267}{3237}$, Am. Mus. Nat. Hist., ♀ ad., Brownsville, Texas, Sept. 3, 1891; F. B. Armstrong.

Geog. Dist.—Southern Texas and northeastern Mexico, from Corpus Christi southward; in the Rio Grande Valley to about the mouth of the Pecos, and thence east to Kerr, Bexar and Bee Counties, Texas.

Specimens Examined.—(See next page).

SPECIMENS EXAMINED.

No. of specimens.	Locality.	Date.	Collector.
2	Santa Teresa, Tamaulipas, Mex.	March 23.......	J. Priour.[1]
2	Del Rio, Val Verde Co., Texas,	Feb. 4–7	Vernon Bailey.[2]
2	Santa Tomas, Webb Co., Texas.	Dec. 3, 4	Wm. Lloyd.[2]
1	Rio Grande City, Texas	June 2..........	" "
1	Turtle Creek, Kerr Co., Texas.	Feb. 21.........	H. P. Attwater.[1]
1	San Antonio, Bexar Co., Texas.	May 15.........	" "
12	Brownsville, Texas...........	Sept. 3–Oct. 6...	F. B. Armstrong.[1]
13	" "	Aug. 2, Sept. 10, Feb. 5-16, Apr. 14, June 8, July 24..	J. A. Loring and F. B. Armstrong.[2]
1	Padre Island, Texas.........	Nov. 1.........	Wm. Lloyd.[2]
1	Corpus Christi, Texas........	April 8	Frank M Chapman.[1]
1	Bee County, Texas...........	January.........	John Priour.[1]
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[1] Collection Am. Mus. Nat. Hist.

[2] Received from U. S. Dept. Agr.

This subspecies differs strikingly in its paler coloration from either *R. mexicanus* or *R. mexicanus aurantius*, as would be naturally expected from the very different character of its habitat. The name *intermedius* is given with relation to its intermediate position geographically between these two forms.

Reithrodontomys mexicanus aurantius, subsp. nov.

LOUISIANA HARVEST MOUSE.

Ochetodon mexicanus COUES, Mon. N. Am. Roden. 1877, 128 (Louisiana specimens only).

Resembling *R. mexicanus*, but more golden in coloration ; much more strongly colored than *R. m. intermedius*.

Adult.—Above strongly yellowish brown, with a distinctly blackish median area ; sides rich orange rufous ; below white, commonly with a faint wash of yellowish, and rarely with an indistinct fulvous breast patch.

Measurements.—Type, ♂ ad.: Length, 174 ; tail vertebræ, 95 ; hind foot, 20 ; ear (from skin), 12 ; ratio of tail vertebræ to total length, 55. (For measurements of additional specimens see Table VI, p. 143.)

Type, No. $\frac{33963}{45998}$, U. S. Nat. Mus. (Dept. Agr. Coll.), ♂ ad., Lafayette, La., May 24 ; 1892 ; R. J. Thompson.

Geog. Dist.—Coast region of Texas from Matagorda County northward and thence eastward to Houma, La. (probably to the Mississippi River), and north to Beebe, Arkansas.

SPECIMENS EXAMINED.[1]

No. of specimens.	Locality.	Date.	Collector.
5	Matagorda, Texas	Feb. 3–8	Wm. Lloyd.
2	East Caranchua Creek, Matagorda Co., Texas	Jan. 6	"
1	Selkirk Island, Matagorda Co., Texas	Jan. 29	"
1	Elliott, Matagorda Co., Texas	Jan. 14	"
6	Barnard Creek, west of Columbia, Brazoria Co., Texas	Feb. 24–Mch. 2,	"
9	Velasco, Brazoria Co., Texas	March 10–13	"
2	Lafayette, La	May 24, 25	R. J. Thompson.
5	Avery, Iberia Parish, La.	Feb. 24–28	E. A. McIlhenny.
1	Houma, Terre Bonne Par., La.	May 13	Vernon Bailey.
2	Beebe, White Co., Ark.	April 19	B. H. Dutcher.
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[1] Received from U. S. Dept. Agr.

This form differs from *R. m. intermedius* in its very much stronger coloration, the general color above being much darker, with the middle of the dorsal area forming a decidedly blackish band, and the fulvous much brighter, approaching an orange shade. March specimens from Velasco are the brightest of the series, but Louisiana specimens, particularly the Lafayette examples, closely approach them, although taken in May. Immature specimens are paler than adults, and approach in coloration *adults* of *intermedius*, as shown in two examples from East Caranchua Creek (western border of Matagorda County, Texas), and by some of the younger Louisiana specimens.

In 1877 Coues recorded (l. c., p. 130, first two lines of Table XXXV) two alcoholic specimens from Grand Coteau, La.—the first record of any form of the *R. mexicanus* group from the United States.

Reithrodontomys fulvescens *Allen.*

SONORAN HARVEST MOUSE.

Reithrodontomys mexicanus fulvescens ALLEN, Bull. Am. Mus. Nat. Hist. VI, 1894, p. 319 (Nov. 7, 1894). Oposura, Sonora, Mexico.

Adult.—Above pale yellowish brown, conspicuously lined with black, darkest along the median line; sides paler, with a pale fulvous lateral line. Below white, the hairs plumbeous at base. Ears dusky externally, rusty within, clothed with fine short hairs. Tail indistinctly bicolor, dusky above, lighter below, clothed with short hairs, concealing the annulations. Feet soiled white.

Measurements.—Total length (type), 183; tail vertebræ, 102; hind foot, 19; ear (from skin), 11.5.

Three adults measure: Total length, 176 (169–183); tail vertebræ, 110 (99–102); hind foot, 19; ratio of tail to total length, 57.

Geog. Dist.—Known only from Oposura, Sonora, Mexico.

Specimens Examined.—Oposura, Sonora, June 1, B. C. Condit (Am. Mus. Nat. Hist.), 3.

Since publishing the original description (l. c.) of this species I have been able to compare the Oposura specimens with large series of the *R. mexicanus* group from various points along the Gulf coast from central Louisiana to the mouth of the Rio Grande. As shown above, these are not only separable from true *R. mexicanus* from Vera Cruz, Mexico, but are themselves separable into two well-marked subspecies, both of which are very unlike the Oposura specimens. Considering the wide geographical area and physical barriers separating the Oposura animal from the forms inhabiting the coast region of Louisiana, Texas and eastern Mexico, and its strongly marked color differences, I am led to give the Sonora form full specific rank, although it evidently belongs to what may be termed the *R. mexicanus* group.

I have before me a single specimen, in rather poor condition, from Mazatlan (No. 9065, U. S. Nat. Mus., Mazatlan, Dec., 1868, F. Bischoff). It is much brighter in color than *R. fulvescens*, and probably represents still another form of the *R. mexicanus* group, peculiar to the west coast of Mexico.

Reithrodontomys costaricensis, sp. nov.

COSTARICAN HARVEST MOUSE.

Adult.—Above ferrugineous brown, finely lined with blackish hairs, passing into brighter, more orange rufous on the sides; below white, usually with a slight wash of yellow, and sometimes with a distinct patch of fulvous on the lower throat and breast. Ears brown, covered with short hairs. Feet whitish, the hind feet with a dusky median stripe above. Tail very long, dusky brown, almost unicolor, nearly naked, the few very short, bristly hairs not concealing the annulations.

Young.—Above brown faintly washed with rusty, the sides brighter, with a distinct brownish fulvous lateral line.

Measurements.—Length (type), 197; tail vertebræ, 111; hind foot, 20.5; ear (from skin), 12: ratio of tail vertebræ to total length, 56.4.

Four adults measure: Length, 196 (194–198); tail vertebræ, 114 (106–123); hind foot, 20.5 (19.8–21.3); ratio of tail to total length, 58.

Type, No. $\frac{9556}{7898}$, Am. Mus. Nat. Hist., ♂ ad., La Carpintera (alt. 6000 ft.), Costa Rica, July 15, 1891; George K. Cherrie.

Specimens Examined.—La Carpintera, Costa Rica, July, November and December, George K. Cherrie, 17 (2 are alcoholics).

Geog. Dist.—All the specimens thus far examined are from La Carpintera, Costa Rica, from an altitude of about 6000 feet.

The large size and strongly reddish coloration of this species render comparison with any other described species of the genus unnecessary. In size, proportion and coloration it closely resembles my *Hesperomys* (*Vesperimus*) (=*Peromyscus*) *cherrii.* In coloration it also closely resembles *Peromyscus aureolus* of the United States.

I.—MEASUREMENTS (AVERAGE AND EXTREMES) OF 37 SPECIMENS OF *R. lecontii*.

Locality.	No. of specimens.	Total length.	Tail vertebræ.	Ratio of tail to total length.	Hind foot.	Ear.
Riceboro, Ga.	6	117 (112–124)	57 (53–60)	48.6 (46.5–49.2)	15.8 (15–17)	9.5 (9–10)
Society Hill, S. C.[1]	4	107 (101.6–118.6)	51.5 (48–57)	48.1 (47.2–51)	14.5 (12.7–15.2)	
Raleigh, N. C.[2]	15	123 (113–134)	58 (53–56)	47.3 (46–50)	16 (14.5–17.5)	
“ “	12	119 (108–141[3])	50 (44–63.5[3])	42 (40.5–44.4)		

[1] Alcoholics; measurements from Baird (Mam. N. Am., p. 440) reduced to millimetres.

[2] The two series from Raleigh were collected and measured by Messrs. H. H. and C. S. Brimley, at intervals of several years, and doubtless represent two slightly different methods of measuring.

[3] This specimen (No. 3222, Coll. C. Hart Merriam) is exceptional for its large size, namely: Length, 141; tail vertebræ, 63.5. The next largest specimen of this series of 9 examples measures: Length, 127; tail vertebræ, 54.

II.—MEASUREMENTS (AVERAGES AND EXTREMES) OF 58 SPECIMENS OF *R. megalotis*.

Locality.	No. of specimens.	Total length.	Tail vertebræ.	Ratio of tail to total length.	Hind foot.	Ear.
Near San Luis Springs, Sonora[1]	1	133	57	42	17.3	11
Fairbank, Arizona	3	143 (141–146)	66 (62–72)	46 (43.9–49.3)	18.5 (18 –19)	12.5 (12 –13)
San Juan Valley, N. Mex.	8	134 (124–148)	63 (57–70)	47 (45 –50)	18.5 (15.7–19)	12.5 (12 –13)
La Plata, N. Mex	18	136 (122–155)	63 (55–73)	47.8 (45.4–49.3)	17.4 (15 –19)	12.5 (12 –13)
Aztec, N. Mex.	14	132 (123–149)	61 (54–67)	46.2 (43.6–48)	17.2 (17 –18)	12.2 (11 –13)
Provo, Utah.	9	131 (126–139)	62 (58–68)	47.3 (46 –50)	17 (16 –18)	12.5 (12 –13)
St. George, Utah.	5	132 (126–146)	64 (58–72)	48.3 (46.2–50)	17 (16 –18)	12.6 (11.5–13)

[1] Type of the species; measurements from Baird (Mam. N. Am., p. 451). Ear measured from crown, instead of from notch.

III.—MEASUREMENTS (AVERAGES AND EXTREMES) OF 128 SPECIMENS OF *R. megalotis deserti.*

Locality.	No. of specimens.	Total length.	Tail vertebræ.	Ratio of tail to total length.	Hind foot.	Ear.
Pahrump Valley, Nye Co., Nev.	11	138 (131–148)	69 (62–76)	50 (47.3–52.2)	17.5 (16.5–18.5)	12.6 (12 –14)
Oasis Valley, Nye Co., Nev.	16	137 (124–149)	71 (66–76)	51.1 (49 –52.6)	18.6 (17 –19)	12.6 (12 –14)
Ash Meadows, Nye Co., Nev.	27	134 (123–146)	68.7 (61–77)	50 (47 –53.6)	17.5 (16 –18)	12.5 (11.5–13.5)
Panamint Mts., Inyo Co., Cal	5	140 (137–143)	67 (65–69)	48 (47.4–48.1)	17 (16 –18)	12.5 (12 –13)
Lone Pine, Inyo Co, Cal.	24	135.3 (123–152)	71 (60–80)	52.4 (46 –57.2)	17.3 (16 –18)	12 (11 –13)
Owens Lake, Inyo Co., Cal	32	138 (124–156)	71 (63–83)	51.4 (43.6–54.2)	17 (16 –18)	12.5 (12 –13)
Winslow, Ariz	13	131 (122–147)	65.5 (59–78)	50 (48.5–53)	17.5 (17 –18)	12.5 (12 –13)

IV.—MEASUREMENTS (AVERAGES AND EXTREMES) OF 76 SPECIMENS OF *R. longicauda.*

Locality.	No. of specimens.	Total length.	Tail vertebræ.	Ratio of tail to total length.	Hind foot.	Ear.
Leesville, Colusa Co., Cal.	6	142 (133–151)	74 (66–79)	52 (49 –54)	17 (16 –18)	11.5 (11 –13)
Lower Lake, Lake Co., Cal.	3	139 (130–146)	73 (63–80)	52 (51 –54)	17 (16 –18)	11.5 (11 –12)
Glen Ellen, Sonoma Co., Cal.	6	136.5 (129–144)	72 (68–79)	52.7 (49 –54.3)	17 (16 –18)	11.2 (10.5–12)
Petaluma, Sonoma Co., Cal.[1]	14	120 (115–134)	65 (57–80)	54.5 (51.9–59.6)	16.5 (15.2–17.8)	
Walnut Creek, Contra Costa Co., Cal.	15	133 (125–143)	69.5 (64–74)	52.2 (50 –54.8)	16.5 (16 –17)	11 (10 –12)
San Mateo, San Mateo Co., Cal	7	137 (130–150)	71 (58–81)	52 (50 –54)	17.5 (17 –18)	10.9 (10 –12)
Monterey, Monterey Co., Cal.	18	140.2 (128–158)	76 (69–89)	54.3 (51 –56)	17 (16 - 18)	11.3 (10.5–12)
Tracy, San Joaquin Co., Cal.	7	132 (120–144)	68.4 (58–77)	51.8 (48.3–54)	16.7 (16.5–17)	11.2 (10 –12)

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[1] Measurements from Baird (Mam. N. Am., p. 452), and mostly from alcoholics. Doubtless the discrepancies in ratio of tail to total length in this series as compared with the other series is due to different methods of measuring; and for this reason the comparison is of interest. Probably also the small size is largely due to the presence of immature specimens. The series is not now available for re-examination.

V.—Measurements (Averages and Extremes) of 65 Specimens of *R. longicauda pallidus.*

Locality.	No. of specimens.	Total length.	Tail vertebræ.	Ratio of tail to total length.	Hind foot.	Ear.
SantaPaula, VenturaCo ,Cal.	17	144 (132–153)	76 (69–83)	54 (50–55)	17 (16–18)	11 (10 –12)
San Fernando, " "	9	141 (133–151)	75 (70–84)	53 (51–55.6)	16.5 (16–17)	11.8 (10 –12.5)
Santa Monica, " "	8	140 (134–150)	74 (72–85)	52.5 (50–58)	17 (16–18)	11.4 (11 –12)
Santa Barbara Co., "	8	143 (135–150)	76 (72–79)	53 (52–54)	16.5 (16–18)	11.7 (11 –12.5)
Santa Ysabel, San Diego Co., Cal.	15	139 (132–159)	76 (72–84)	54.5 (53–58)	17 (16–18)	11.5 (10.5–12.5)
Jacumba, etc., San Diego Co., Cal.	8	145 (135–160)	76 (70–83)	52.5 (50–54)	17 (16–19)	11.6 (11 –12)

VI.—Measurements (Averages and Extremes) of 27 Specimens of *R. mexicanus aurantius.*

Locality.	No. of specimens.	Total length.	Tail vertebræ.	Ratio of tail to total length.	Hind foot.	Ear.
Velasco, Matagorda Co., Texas.	7	168 (158–182)	94 (85–109)	56 (53 –61)	21 (20 –22)	11.2 (10.5–12)
Barnard Creek, near Columbia, Brazoria Co., Texas.	6	165 (152–180)	94 (84–105)	57 (52.4–61)	21 (20.5–22)	11.2 (10 –12)
Matagorda, Texas	5[1]	152 (144–176)	87.4 (81– 92)	57.5 (52.3–61)	20.8 (20 –22)	11 (10 –12)
Avery, Iberia Parish, La	5[1]	157 (152–159)	88 (86– 92)	56 (55.9–56.3)	19.2 (19 –20.5)	11.5 (11 –12)
Lafayette, Lafayette Par., La.	2	172.5 (171–174)	89 (83– 95)	52 (50 –54)	18.5 (17 –20)	11.5 (11 –12)
Beebe, White Co., Ark.	2	166.5 (163–170)	90.5 (89– 92)	54.5 (54 –54.6)	20 (20 –20)	11 (11 –11)

[1] Mostly young adults.

Article IV.—ON THE OSTEOLOGY OF AGRIOCHŒRUS.

By J. L. Wortman.

Plate I.

Although the genus *Agriochœrus* has been known for many years, and has always been abundantly represented in our collections by numerous complete skulls, yet it was not until the past year that we have obtained any information regarding the remainder of its skeletal structure. The first intelligence of the very curious organization of its feet was published by Professor Osborn and myself in the description of a remarkable hind foot[1] from the Protoceras layer of the White River beds, obtained by the Museum Expedition in 1892. On account of the large claw-like ungual phalanges, and in the complete absence of teeth, we referred it to the order Ancylopoda, established by Cope, and considered it to represent a distinct subdivision of this group (Artionychia). Professor Scott, upon careful examination of the specimen, shrewdly surmised that the foot probably pertained to a species of *Agriochœrus*.

The explorations of the past year have demonstrated the correctness of this surmise, and he has added to our knowledge of the genus by a description of a portion of the fore limb.[2] He has also, in the same paper, discussed at some length the systematic position of the genus within the Artiodactyla. Another important addition to our knowledge of the probable ancestral genus has recently been made by Professor Marsh in the description of a new form (*Hyomeryx breviceps*) from the older Uinta beds.[3]

During the past year the expedition from the American Museum into the White River beds, near the same locality where the hind foot was found, was fortunate enough to discover a more or less complete skeleton of *Agriochœrus latifrons*, together with numerous skulls and other important parts of the skeleton of different individuals of other species, so that the materials are now at hand to enable me to give a tolerably thorough account of the osteology of one of the species at least. Another considerable addition to the materials that I was fortunate enough to obtain, was found in the Cope Collection, which the Museum has recently acquired, consisting of a complete skull associated with numerous limb bones and vertebræ of a single individual, collected by myself in 1879 in the John Day Basin in Oregon. This specimen has aided me materially in supplying the missing parts in making the restoration. It may be added here that the association of the large claw-like terminal phalanges with the teeth, in at least two of our White River specimens, leaves no room for doubt as to the correctness of the determination that this type of ungual phalanx belongs to *Agriochœrus*.

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[1] 'Artionyx, a New Genus of Ancylopoda,' Bull. Amer. Mus. Nat. Hist., Feb., 1893, pp 1-18.

[2] 'Notes on the Osteology of Agriochœrus,' Amer. Philos. Soc , May, 1894, pp. 244-251.

[3] 'Description of Tertiary Artiodactyles,' Amer. Jour. Sci., Vol. XLVIII, Sept., 1894, pp. 259-274.

It is the object of the present paper, therefore, to present as complete an account as possible of the osteology of this group, together with a critical review of the species which have been described as belonging to it. Following this I will take up the question of the systematic position of the group.

OSTEOLOGY.

Skull.—This part of the osteology has been so thoroughly described by Leidy, Cope, and Scott, that little remains to be said concerning it. It may not be amiss, however, to recall some

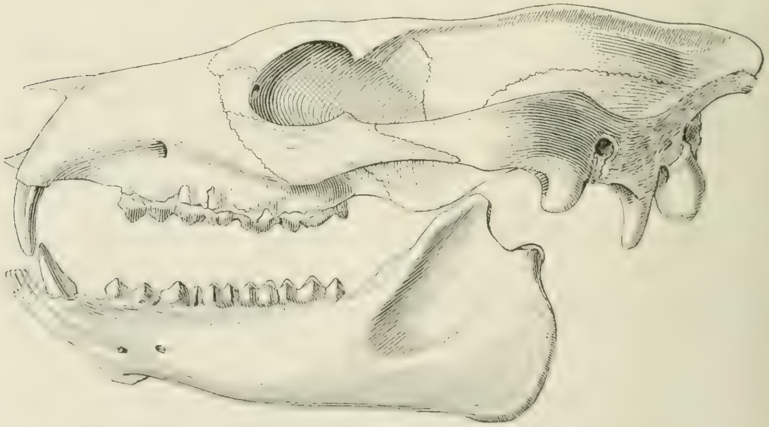

Fig. 1. Side view of skull of *Agriochœrus major*. One-third natural size.

of the more important characters in which it differs from its nearest cotemporary selenodont allies—the Oreodontidæ—as well as those characters in which it resembles them. The general outline of the skull is very much like that of the earlier Oreodonts, especially *Oreodon culbertsoni*, with which Leidy compared it in his original description. It is rather elongated and narrow, with moderately elevated, compressed, overhanging occiput. The face is but little bent down on the basicranial axis, and the form and relationship of the facial bones, with the notable exception of the premaxillaries, are practically the same as in *Oreodon*. The otic bullæ are always inflated, they are not filled with cancellous tissue, and the foramina at the base of the skull are similarly disposed as in *Oreodon*. An apparently constant exception to this latter correspondence, however, is seen in the presence of a moderate sized foramen, generally equal to or slightly larger than the *foramen opticum*, which opens just in front of the sphenoidal spine, in *Agriochœrus*. It is situated above and a little posterior to the *foramen opticum*. The office of this foramen, as well as its homology, is difficult to determine, but judging from its size and direction I am inclined to regard it as the *foramen rotundum*.

The principal characters in which the skull of *Agriochœrus* differs from that of *Oreodon* may be enumerated as follows: In *Agriochœrus* the premaxillaries are reduced and practically edentulous. In our collections there are three skulls of different species, in which these bones are in a good state of preservation, and they show that the premaxillaries were not in contact in the median line; they are small and project but little in advance of the canines. There is a single, small, shallow alveolus upon either side from which the incisors had apparently been shed early during life. In all the cotemporary Oreodonts, on the other hand, the premaxillaries are well developed; they are in contact in the median line, and always bear their full complement of incisors. Some of the later forms, however, show a marked tendency to incisor reduction.

In *Agriochœrus* the posterior rim of the orbit is not enclosed by bone, whereas in *Oreodon* the bony ring of the orbit is complete, and there is always a distinct preorbital pit or fossa which is absent in *Agriochœrus*. In the more primitive Oreodont genus, *Protoreodon*, however, the orbit is open posteriorly as in *Agriochœrus*, and there is no lachrymal pit.

The dentition of *Agriochœrus* presents some striking resemblances to the true Oreodonts ; in other respects it more nearly approximates *Hyopotamus*, while in others still it possesses characters peculiarly its own. The most characteristic Oreodont feature is seen in the enlargement of the first inferior premolar into a caniniform tooth, while the true canine is small, incisiform, and so placed as to form a continuous series with the incisors. The upper canine is large, considerably curved, and has a characteristic D-shaped pattern on cross section, as is seen in all the Oreodonts. The characters in which the dentition of *Agriochœrus* departs from that of *Oreodon* are especially seen in the presence of a diastema between the canines and premolars in the upper jaw and between the caniniform first premolar and the second premolar in the lower jaw. In *Oreodon* all the teeth are arranged in a continuous series.

The structure of the molars presents many important differences from those of *Oreodon ;* the crowns are lower, less selenodont, the valleys are much more open, and the angles of the superior teeth more rounded off. In *Oreodon* the external median buttress is compressed from before backwards into a vertical plate, whereas in *Agriochœrus* it forms a wide loop. If it were not for the absence of the anterior intermediate cusp, the molars of *Agriochœrus* would resemble those of *Hyopotamus* very closely. The only genus known to me in which the structure of the superior molars is strictly comparable is *Merycopotamus* of the Indian Miocene, and it would not indeed be surprising to find, when the osteology of this latter genus is more fully known, that the two are quite closely related.

The Vertebræ.—There is no single specimen in our collection which contains a complete vertebral column, so that the exact number of vertebræ cannot be made out with certainty. In one, however, in which the limbs are more or less complete, the posterior five dorsals, all the lumbars, the sacrum, and nineteen of the caudals are preserved. In this specimen there are six lumbars, and if we allow thirteen as the number of the dorsals, we will then have the highly characteristic dorso-lumbar formula for all the known Artiodactyla.

The *atlas* presents the same general outline as that seen in the Artiodactyla. The articular cavities for the condyles of the skull are deep and spacious and are overhung by the anterior superior part of the arch. In *Oreodon* and all the recent genera this part of the arch is interrupted by a wide notch which shortens its fore and aft extent. In *Agriochœrus* this notch is very narrow, and is continued upwards and backwards as a deep groove which separates the spine into two low indistinct tubercles. The transverse processes are well extended laterally, somewhat broader in front than in *Oreodon*, and project backwards further behind the facets for the axis. They are perforated by moderate sized foramina for the passage of the vertebral artery, which does not appear to be the case in any specimen of *Oreodon* which I have examined. Anteriorly, the foramen for the exit of the suboccipital nerve is large and conspicuous, while the inferior tubercle is small. The facets for the axis are more transverse, and not so oblique as in *Oreodon*, resembling more nearly the sheep or deer in this respect.

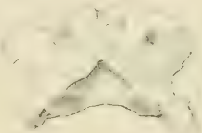

Fig. 2. Top view of atlas of *Agriochœrus guyotianus*. Two-fifths natural size.

The *axis*, as described by Scott,[1] differs from that of *Oreodon*. This is especially to be seen in the character of the spine. In *Agriochœrus* it is unusually high and prolonged in front, so as to overhang the odontoid slightly, while behind it is not so produced, reaching no further than the extremity of the posterior zygapophyses. In *Oreodon* the spine is much lower, but little produced in front, but greatly thickened and extended posteriorly. The odontoid, as already well known, is intermediate between the peg-like form of the pig and the hollow half-cylinder of the higher forms. In some of the larger specimens in our collection

Fig. 3. Side view of axis of *Agriochœrus guyotianus*. Two-fifths natural size.

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[1] Beiträge zur Kentniss der Oreodontidæ, p. 361. It is also stated in the same paper (p. 322) that the atlas of *Oreodon* has the transverse processes perforated by the vertebral canal. In all the specimens in our collection the transverse processes are imperforate, but the position of the canal is frequently indicated by a pit of variable dimensions.

the odontoid is almost as highly developed as in any of the living genera. The remaining cervicals are very much like those of *Oreodon;* they are provided with prominent hypopophyses and moderately developed neural spines, which increase rapidly in length from before backwards.

The *dorsals* resemble those of *Oreodon* very closely, so far as can be determined from our somewhat imperfect material of this region. The spine of the first dorsal, however, is much longer than that of the corresponding vertebra of this genus. The posterior six have rather elongated, slightly keeled centra, with nearly flat oval faces. In the ninth, tenth, eleventh and twelfth, the zygapophyses are nearly flat, while those of the thirteenth begin to assume the tongue and groove pattern of the lumbars. The neural spine of the ninth is high and backwardly directed, that of the tenth being more nearly vertical. From this point backwards the spines have a more forward direction. The transverse processes begin at the eleventh and become more and more prominent posteriorly. Metapophyses are fairly well indicated on the last two dorsals.

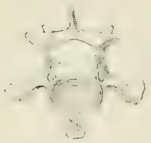

Fig. 4. Front view of cervical of *Agriochœrus guyotianus.* Two-fifths natural size.

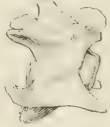

Fig. 5. Side view of cervical of *Agriochœrus guyotianus.* Two-fifths natural size.

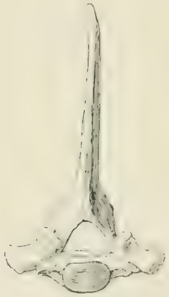

Fig. 6. Anterior view of first dorsal of *Agriochœrus guyotianus.* Two-fifths natural size.

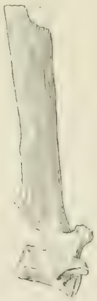

Fig. 7. Side view of first dorsal of *Agriochœrus guyotianus.* Two-fifths natural size.

The *lumbars* are six in number. The second, third and fourth have moderately strong ventral keels, the two last being practically without this structure. The centra increase in size and length from before backwards, the last two being markedly flattened vertically; the central faces exhibit a slight convexity both in front and behind, except that of the last lumbar, where it joins the sacrum, which is nearly flat. The spines are broad and elevated, and the metapophyses well developed. The zygapophyses

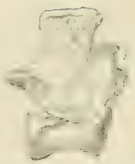

Fig. 8. Side view of second lumbar of *Agriochœrus latifrons*. One-third natural size.

exhibit a well-marked double tongue and groove articulation, a feature so highly characteristic of the Creodonts. In *Oreodon* this tongue and groove is always apparently single, at least all the specimens I have examined fail to show any trace of the double structure.

The *sacrum* is composed of three vertebræ, and resembles that of *Oreodon* as nearly as can be determined.

The number of the *caudals* cannot be stated with certainty; there are, however, nineteen preserved in one specimen, and if one is permitted to judge from the way in which they would ordinarily taper, at least three or four should be added to this number. The proximal ones are short with well-developed neural arches and zygapophyses; these latter structures disappear in the fourth or fifth caudal, while the arch continues to the seventh or eight. They lengthen rapidly towards the middle of the tail, after which they again become shorter. There is no evidence of chevrons having existed, although it is not at all improbable that they were present.

The *ribs* do not present any characters worthy of especial mention, further than to say that the anterior ones were stout and considerably flattened. The middle ones were larger, indicating a spacious chest, while towards the posterior end of the series they become more rounded and smaller.

The *sternum* is represented in the collection by a single segment, which I take to be the second sternal bone. It may be described as an elongated bar, expanded at either extremity and greatly constricted in the middle. It is grooved upon its ventral aspect, and exhibits at either antero-inferior angle a prominent process; posteriorly it is not so broad as it is in front. Upon either side about midway of the bone, in a deep salcus, is seen a facet for a rib, presumably the second. In all the recent forms of the Artiodactyla the cartilaginous ribs join the sternum at the point where the segments meet, except the first, which is located near the anterior extremity of the manubrium. If our specimen is to be homolo-

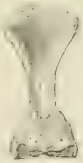

Fig. 9. Ventral view of second (?) sternal bone of *Agriochœrus latifrons*. One-third natural size.

gized with the manubrium or anterior sternal bone, then the relatively great expansion of its anterior extremity is peculiar. I have not seen a specimen of this part of the sternum of *Oreodon*, so that I am unable to state whether there is any resemblance or not.

Fore Limb.[1]—The fore limb of *Agriochœrus* is found to differ from that of *Oreodon* in many important particulars when the two structures are carefully compared. Aside from the great differences seen in the character of the ungual phalanges and carpus, presently to be described, the limb is both relatively longer and more robust than in any of the Oreodonts. While *Agriochœrus latifrons* is nearly of the same size as the larger specimens of *Oreodon culbertsoni*, yet the long bones are more than one-third longer; this disproportion extends also to the elements of the manus, but the whole foot, especially the metapodials, are more nearly equal to those of *O. culbertsoni*.

The *scapula* of *Agriochœrus latifrons* in our collection is represented only by its distal third, including the glenoid cavity, coracoid, acromion and part of the spine, in good state of preservation. In a smaller specimen of *A. guyotianus*, from the Oregon beds, however, the whole bone is sufficiently preserved to admit of a determination of its more important characters. Its general proportions are very similar to those of *Oreodon culbertsoni*, with some slight exceptions. The spine divides the dorsal surface into two subequal fossæ, of which the supraspinous is slightly the larger. The acromion is prominent, somewhat thickened and pointed, and projects in such a way as to overhang the neck of the bone. As in *Oreodon*, a small though distinct metacromion process is present. In *Oreodon* this process is narrow and terminated by a point, while in *Agriochœrus* it is placed relatively further back from the acromion, being at the same time more extended along the crest of the spine and not so distinctly pointed. It is interesting to note that this process has almost entirely disappeared in the later selenodont Artiodactyles, being represented only by a slight thickening of the crest of the spine, which is located far back near its middle. In the Suellines, on the other hand, it is strongly developed, but situated at a still greater distance from the glenoid cavity. The coracoid is small and less distinctly constricted off from the rim of the glenoid cavity than in *Oreodon.* The glenoid cavity is more oval in form than in *Oreodon*, its greatest diameter being in the transverse direction. While the neck of the bone is relatively shorter and thicker than in *Oreodon*, the axillary and coracoid borders exhibit practically the same relations to the rest of the bone. The vertebral border is not well preserved in any of our material.

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[1] Scott has described a part of the fore limb of one of the larger species of this genus ('Notes on the Osteology of *Agriochœrus*,' Amer. Philos. Soc., May, 1894, pp. 243–251), but as his materials were not complete, I have thought best to give a description of our specimen in full.

The *humerus*, as already remarked, is proportionately much longer and to a slight extent more robust than the corresponding bone in *Oreodon.* The head has nearly the same shape, but does not overhang the shaft to the same extent. The greater tuberosity is prominent and distinct, but it does not rise above the articular surface to the same extent as is seen in either *Oreodon* or any of the recent forms of the Artiodactyla; its antero-posterior extent, however, is considerable, and its posterior portion is as much elevated as its anterior, which is, apparently, not true of any other form with which I am acquainted. The lesser tuberosity is large and prominent, but does not rise above the level of the articular surface as it does in *Oreodon*, the pig, camel, sheep and deer. The bicipital groove is wide, deep and single, and the inconspicuous deltoid crest reaches far down the shaft in marked contrast to its proximal position in many of the recent genera.

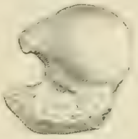

Fig. 10. Head of humerus, top view, *Agriochœrus latifrons.* One-third natural size.

The characters of the distal end of the humerus appear, at first glance, so remarkable that one would hesitate to place it in the ungulate series, but a more careful study reveals the fact that its nearest affinities are in all probability with the primitive Artiodactyla. That which causes it to appear so remarkable at the first glance is its great breadth as well as the unusual size of the internal condyle. Another marked feature, which gives to it a distinctly carnivorous appearance, is the cylindrical form of the shaft and its decided antero-posterior flattening as it approaches the distal end. What may be described as an extremely constant and highly characteristic feature of the recent Artiodactyle humerus is its very straight internal border, together with the lateral flattening of the shaft. If a line be drawn down this border it will just cut the inner edge of the distal articular surface. This is exemplified in its greatest perfection in the Bovidæ and Cervidæ, although it is almost equally true of the camels and pigs. In all these forms the internal condyle has quite completely disappeared, which gives to the whole distal end of the bone a laterally compressed appearance. Now in *Oreodon* we meet with some important deviations from this type of humerus; the internal border is not so straight, the shaft is not so compressed laterally, and there is an internal condyle of moderate proportions present. It can readily be seen, however, on placing the humerus of a deer and an *Oreodon* side by side that these parts of the two bones are very much alike, and it is also to be remarked that in those particulars in which *Oreodon* departs from the deer, in these respects it approaches *Agriochœrus*.

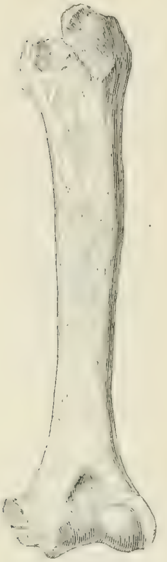

Fig. 11. Humerus of *Agriochœrus latifrons*. Front view. One-third natural size.

The distal end of the humerus of *Oreodon* and all the recent genera differs from *Agriochœrus* not only in the size of the internal condyle and the relative breadth, but also in the peculiar and characteristic way in which the comparatively thin internal border of the anconeal fossa is prolonged downwards so as to form the most dependent part of the bone. The camels furnish an exception to this rule, the flange of the inner trochlea reaching as low or a trifle lower than this process. In *Agriochœrus* the inner border of the anconeal fossa is thick, rounded off below, and passes into the internal condyle, the most dependent part of the bone being formed by the flange of the inner trochlea.

The distal articular surface of the bone presents a number of interesting characters which are quite in keeping with the other peculiarities already noted. The surface is rather imperfectly divided into an internal and external trochlea by a low, thick, inconspicuous carina, which is placed nearer the outer than the inner side. It results from this that the inner trochlea is much the larger of the two, as is so markedly the case in all the recent forms of Artiodactyles, but not so in *Oreodon*. The inner boundary of this trochlea is indicated by a prominent flange, which does not extend more than halfway around to the posterior side. When looked at from below, the upper or anterior profile of the surface is seen to descend at first greatly towards the middle, then more abruptly to form the principal groove of the internal trochlea, after which it rises again to correspond with the carina. The external trochlea is deeper, narrower and terminated externally by a prominent flange. The whole distal end of the bone more nearly resembles that of a bear than an Ungulate. A marked difference, however, is seen in the comparatively deep anticubital fossa, which in the bear is but slightly developed. As compared with *Oreodon*, the main differences are seen in the disparity in size between the two trochleæ and the weaker development and breadth of the carina. In *Oreodon* the two trochleæ are subequal, whereas in the recent genera the internal greatly exceeds the external in breadth, as in *Agriochœrus*.

The *radius* is long and rather slender in proportion to its size. The proximal articular surface is divided into three facets, which when applied to the humerus, cover a large part of its distal extremity. The innermost of these facets is placed somewhat obliquely to the head of the bone, is slightly cup-shaped, and looks upwards and inwards. In conjunction with the inwardly projecting shelf-like facet on the ulna, it covers the inner part of the internal trochlea of the humerus when the bones are placed in apposition. It is separated from the median or central facet by an inconspicuous ridge; this latter facet forms a wide shallow depression, being limited in front by the thickened, prominent edge, which is fashioned into an indistinct tubercle. When applied to the humerus, this surface serves to receive the carina of that bone. The outer of the three facets is of a lunate pattern,

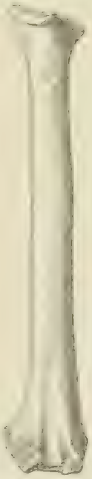

Fig. 12. Radius of *Agriochœrus latifrons*. Anterior view. One-third natural size.

beginning in front near the middle of the head and passing outwards and backwards to terminate at its postero-external angle. It presents a curious bevel, so that its surface looks upwards, forwards and outwards, being at the same time slightly concave from side to side. When the radius is placed in its natural position, and the fore arm extended, a wide space is left between the anterior part of this facet and the outer trochlear surface of the humerus. It is only when the forearm is strongly flexed that it engages with its proper articular surface of this latter bone, and it is a matter of no little interest to note that the mechanism of the joint is such that when this extreme flection is made the outer border of the whole manus is rotated to that extent that the palmar surface looks almost directly inwards. If there is anything in the hypothesis, that the particular way in which the foot has been used is responsible for its modification, then we have a very distinct reason why the fourth digit should have been equally developed with the third, so as to produce the paraxonic type. That part of the head of the radius which is applied to the ulna is greatly flattened, and is provided with a long, narrow, transverse facet reaching entirely across the bone. There can be no doubt, therefore, that the radius was capable of considerable movement upon the ulna, but owing to the flattened character of the facet this movement was not a rotary one.

The shaft is, in its proximal third, considerably flattened from before backwards, but towards its distal portion becomes thicker and more angulated. The distal end is expanded and marked upon its anterior surface by distinct tendinal grooves for the extensor muscles. The facets for articulation with the scaphoid and lunar are distinct, although this is not plainly indicated in front. Posteriorly the scaphoid facet is produced into a rounded transverse ridge, which is received into a corresponding depression of this bone. The facet for the head of the lunar is excavated, as is the anterior part of the scaphoid articulation. Neither of these facets present any marked obliquity.

The *ulna* is long and slender, and shows no tendency to that extreme reduction seen in the later Artiodactyla. The olecranon is relatively short, stout and thick, and is provided with a distinct groove at its posterior end, as in *Oreodon*, *Protoceras*, *Leptomeryx*, and in the Carnivora. The office of this groove was probably for the accommodation of the tendon of the triceps during extreme flexion of the forearm upon the humerus. The sigmoid cavity is of moderate depth, and its inferior boundary rises up into a rudimental coronoid process. The internal part of the articular surface of this cavity projects as a considerable ledge, which is not covered by the radius when these bones are articulated. The shaft is stout and heavy in its proximal portion, but is decidedly flattened and thinner in its middle and distal portions. It is deeply grooved upon its outer and inner sides. The distal end is expanded somewhat, and displays an antero-posteriorly rounded surface for articulation with the cuneiform, and a distinct postero-external facet for articulation with the pisiform.

Fig. 13. Ulna of *Agriochœrus latifrons.* Anterior view. One-third natural size.

A comparison of the ulna and radius of *Agriochœrus* with those of *Oreodon* shows a great number of similarities. The head of the radius in *Oreodon* is not so broad, but at the same time covers the ulna more completely; this results principally from the less developed internal shelf which forms the floor of the sigmoid cavity. The inner side of the shaft of the ulna is not grooved in *Oreodon*, whereas it is deeply grooved in *Agriochœrus*. The distal end of the radius is slightly different in the two genera, but not to such an extent as to indicate a very wide separation. The distal end of the ulna in *Oreodon* shows no distinct facet for the pisiform, being very much rounded from before backwards; in *Agriochœrus* it is thicker, not so rounded, and has a distinct facet for the pisiform.

The Manus.—The carpus of *Agriochœrus* is in many respects exceedingly primitive for that of an artiodactyle Ungulate. If the serial arrangement was the primitive one for the Ungulata, as Cope has suggested, then the shifting of the proximal upon the distal row has made less progress in this respect than in almost any other Artiodactyle yet described. The cuneiform rests exclusively upon the unciform, the lunar almost wholly upon the magnum, while the scaphoid is largely supported by the trapezoid and trapezium ; it has, however, developed a considerable contact with the magnum as well, but not to the same extent seen in the large majority of other members of the order. Another striking feature of the carpus is the vertical flattening of many of its elements, especially the scaphoid.

The *scaphoid*, as just observed, is chiefly remarkable for its great width in proportion to its height. In the Artiodactyla in general this is a high and narrow bone, but in *Agriochœrus* it may be described as flat and broad. When viewed from above it presents a subcircular outline, somewhat more narrowed upon its inner than its outer side. The radial facet is cup-shaped, with the anterior lip rounded off. Upon its distal surface there is a narrow, antero-posteriorly directed, internal facet for articulation with the magnum, and a larger external oblique facet for articulation with the trapezoid. *There is no facet for the trapezium*, although this bone is present and of considerable size.

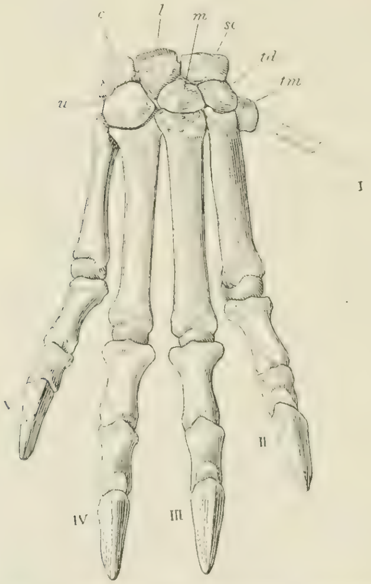

Fig. 14. Fore foot of *Agriochœrus latifrons*. One-half natural size.

The facet for the magnum is divided into two parts, an anterior, nearly plane, and a posterior, concave portion for the articulation with the head of this latter bone. Upon the outer side this facet passes into the surface by which the scaphoid articulates with the lunar. The internal or trapezoid facet is much the larger of the two, and is also divided into two parts, separated from each other by an indistinct oblique ridge ; the posterior of these is concave, like that for the head of the magnum, and serves to receive the posterior elevation of the trapezoid. The anterior part of the facet is nearly flat, with but a slight concavity. Near the middle of the distal surface of the bone, where the anterior and posterior divisions of these two facets meet, is a prominent tubercle.

A comparison of the scaphoid of *Agriochœrus* with that of *Oreodon* shows many important differences in detail. In *Agriochœrus* it is unusually low and flat, whereas in *Oreodon* it is relatively high and narrow, approaching more nearly in shape that of the modern type as seen in the pig, deer, sheep and camel. In *Agriochœrus* the radial facet is concave with the anterior lip comparatively little rounded off, while in *Oreodon* it consists of a prominent, transversely convex, and a posterior, deeply concave portion of nearly equal extent. In *Agriochœrus* the magnum facet has little obliquity, and is almost as broad in front as behind; in *Oreodon* this facet is very oblique and is much broader in front than behind. Another important difference is seen in the relative size and shape of the trapezoid facet. In *Agriochœrus* it displays a posterior convex and an anterior nearly flat surface, while in *Oreodon* there is but a single division, which is saddle-shaped. In *Oreodon*, again, there is a distinct facet for the trapezium, notwithstanding its reduced size, whereas in *Agriochœrus* this facet is completely wanting.

The *lunare* is quite as characteristic as the scaphoid ; it has the same general shape as that of the Oreodonts, but its relationship to the surrounding bones is very different. It differs from all the recent forms, and agrees with the Oreodonts in the great development of the anterior wedge-shaped process which projects downwards in front between the unciform and magnum. The length and size of this process gives the bone a high and narrow appearance, the head being strongly convex from before backwards. The facet for articulation with the scaphoid is narrow and elongated ; that for the cuneiform is flat and vertical, and becomes continuous with a vertical articular face upon the ulnar side of the wedge-shaped process where it touches the unciform. The distal surface is made up of a deep, transversely excavated, posterior part for articulation with the head of the magnum, and an anterior, more or less flattened, oblique portion which rests upon the inner oblique shelf of the same bone. Upon the ulnar side of this excavated facet, and more or less continuous with it, is a small facet which receives a spur-like lateral process from the unciform. It results from this arrangement that the lunar rests almost wholly upon the magnum, the contact with the unciform, with the exception of the small lateral spur just mentioned, being vertical. In *Oreodon*, on the other hand, this arrangement is just reversed, the vertical contact being with the magnum instead of the unciform, upon which the lunar principally rests. There is, however, a small oblique facet posteriorly which serves to receive the head of the magnum. So different, indeed, is the lunar in the two genera that one would readily mistake the one from the right side of one as pertaining to the left side of the other, and conversely.

The *cuneiform* is relatively smaller than in *Oreodon*, and of considerably less extent ; its ulnar facet is deeply concave from before backwards, and the facet for the pisiform is of much the same shape and proportions as in *Oreodon*. The facet for the unciform is single, more or less cup-shaped, and differs from that of *Oreodon*, in which there is an additional facet at the postero-external angle of the bone.

The pisiform resembles that of *Oreodon* in its general form, but it is relatively longer, heavier and with a more expanded distal extremity. The two facets are subequal, whereas in *Oreodon* that for the cuneiform considerably exceeds that for the ulna.

The *unciform*, while it resembles that of *Oreodon* in a general way, nevertheless exhibits a number of striking differences. The prominent posterior hook projects backwards, downwards, and slightly outwards. The cuneiform surface is very convex from before backwards, and the postero-internal angle terminates in a lateral spur which projects under the lunar. Just in front of this spur is an almost vertical, concave facet with the concavity directed inwards, which articulates with the anterior descending process of the lunar already mentioned ; at a considerable distance behind this facet, at the base of the hook, is a small, indistinct articular surface, which is the only point where the magnum touches the unciform. The distal face is occupied by three facets—an outer one, greatly elongated from before backwards, for the support of the fifth metapodial ; a middle larger one for the fourth, and an inner oblique one for the outer process of the third. As compared with *Oreodon* the posterior hook projects less strongly outwards, and the proximal surface is much less oblique. The internal spur in *Oreodon* is swollen into a large process, which forms the chief support for the lunar, having usurped the principal function of the head of the magnum. The cuneiform facet is relatively much smaller than in *Agriochœrus*, and is, moreover, double. The facet for the articulation of the descending process of the lunar is much larger and less vertical, while that for the articulation with the magnum is a small vertical circular area, upon the radial side of the inwardly projecting spur.

The *magnum* differs widely from the corresponding bone in *Oreodon*, almost if not more than *Oreodon* does from the modern type, as seen in the pig, camel and deer. It is proportionally larger and stronger than in *Oreodon*, and has a much greater posterior breadth. Upon its proximal surface the prominent, strongly convex head rises abruptly from the scaphoid and lunar facets in front ; it is divided by a faint ridge into two portions for articulation with these two bones, of which that for the lunar is much the larger, and displays a marked obliquity from without inwards. In *Oreodon* the head is placed much nearer the anterior margin, is strongly keeled in front, and its obliquity is from within outwards—just the reverse of that seen in *Agriochœrus*. In *Agriochœrus* the lunar facet in front is broad and transverse, while that for the scaphoid is small and more or less vertical. In *Oreodon* again this condition is reversed, the scaphoid facet being broad and transverse, and that for the lunar being small and vertical. In *Agriochœrus* the posterior part of the magnum is as broad as the anterior, and it is terminated behind by a stout rounded process. In *Oreodon* the bone narrows very rapidly behind and terminates in a slender, inwardly projecting, hook-shaped process, which winds around the head of the second metacarpal, developing a distinct facet in this situation. Were it not for the presence of this hook, one might easily be led to mistake the two bones of the same side in these genera for the opposite bones of the same species. The distal surface for the support of the third metacarpal does not present any characters worthy of especial remark.

The *trapezoid* is nearly double the size of the corresponding bone in *Oreodon.* It articulates with the magnum by two distinct facets, a larger, anterior, and a smaller, posterior one; its facet for the scaphoid is broad and nearly flat in front, but rises into a prominent tubercle behind. Upon the radial side there is a small though distinct facet where it articulates with the trapezium; its distal surface is saddle-shaped, and is occupied entirely by the head of the second metacarpal. The only noticeable difference between *Agriochœrus* and *Oreodon* as regards this bone, is seen in the relative size and the facet for its articulation with the magnum. In *Oreodon* there is but a single facet.

The *trapezium* of *Agriochœrus*, at least in the species under consideration, is not only remarkable for its connections, but what is still more surprising, it gives evidence of having supported a more or less opposable pollex. It is the smallest of the carpal elements and considerably reduced in size, but not so much so as to have been entirely functionless. Its proximal part bears two distinct facets for articulation with the trapezoid and the second metacarpal. One of the surprising features about it is that it has no connection with the scaphoid. Distally it displays a distinctly saddle-shaped facet for articulation with the metapodial of the pollex. Taking into consideration the fact that the bones of both sides are preserved, and that when placed in position they fit accurately, there can be no mistake regarding the *more or less opposable position, at least, of the first digit.* It differs from that of *Oreodon*, in which the trapezium is small, nodular, and articulates with the scaphoid; the direction of its metacarpal facet, moreover, indicates that the pollex projects in the same line as the other digits.

The *metacarpals* are somewhat longer and more slender than those of *Oreodon*, and the difference in length between the third and fourth is less marked. When the phalanges are added, however, the third digit is seen to be a little longer than the fourth. In length, the third metacarpal exceeds the others, after which come the fourth, second, fifth and first in the order named. In the matter of robustness, the second surpasses all the others, the fifth being smaller and decidedly more slender. With the notable exception of the pollex the metacarpals are articulated in the same way as those of *Oreodon*, as is also the case in the manner in which they are supported by the various carpal elements. The distal ends of the metacarpals, like those of the metatarsals, are very rounded and prominent, especially upon their dorsal surface, in this respect resembling the Carnivora much more than the Ungulates; in this they differ markedly from those of *Oreodon*. In all there is a strong keel, which is confined to the palmar aspect of the extremity. The metacarpal of the pollex is represented in the collection by only its distal portion, which is imbedded in matrix in such a manner in connection with the metacarpal of the second digit as to leave no room for doubt as to its presence; it is relatively larger than the corresponding bone in *Oreodon*, and is much compressed laterally. Its proximal end is not preserved, but judging from the saddle-shaped facet at the distal end of the trapezium, it is fair to presume that it had a corresponding surface.

The *phalanges*, especially those of the proximal and median rows, are decidedly longer and more slender than those of *Oreodon*, having at the same time the heads much more laterally expanded. This feature is indeed so strongly marked that one would readily mistake any of the proximal phalanges for those of a cat; this likeness is not confined to the head alone, but extends to the distal extremity as well, where the narrow, deeply-grooved facet is very feline in appearance. The median phalanges are high and strongly compressed from side to side, in marked contrast to those of *Oreodon*, in which they are broad and depressed; their proximal ends are more deeply grooved than in this genus, and the dorsal extremity of the articular facet is produced into a prominent overhanging spine, which is but faintly indicated in *Oreodon*. The distal articular facets are carried much further back upon the dorsum of the phalanges than they are in *Oreodon*, a fact which points to a much greater flexibility of the ungues and constitutes a nearer approach to the modern condition found in so many of the Artiodactyla. It is, however, in the ungual phalanges that the most striking peculiarity of *Agriochœrus* is seen, and did not the remainder of the skeleton bear the unmistakable stamp of its ungulate affinities, one would be led to place it in another order. So remarkable is their shape

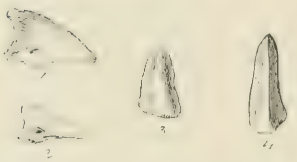

Fig. 15. Ungual phalanges. Side and top views. 1 and 4, *Agriochœrus latifrons*; 2 and 3, *Oreodon culbertsoni*. One-half natural size.

that they merit the name of claws rather than that of hoofs. They are high, compressed, and curved, ending in a blunt downwardly projecting point; the dorsum is strongly keeled and much curved, while the plantar aspect is broader and less curved. The proximal articular surface is deeply excavated to fit the strongly convex surfaces of the median phalanges. The ungual phalanges of *Oreodon* are simply hoofs of the ordinary primitive Artiodactyle type, so that no comparison is necessary.

The Hind Limb.—There is no great disproportion in length between the fore and hind limbs of any of the species of *Agriochœrus*, so far as our material will permit one to judge. The femur slightly exceeds the humerus in length, the tibia is a trifle longer than the radius, and the manus and pes are subequal.

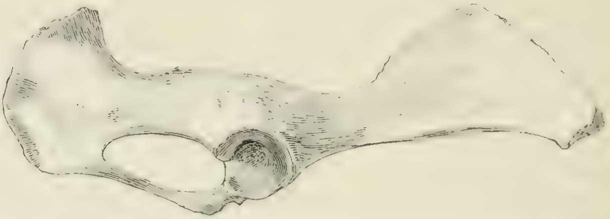

Fig. 16. Pelvis of *Agriochœrus guyotianus*. Two-fifths natural size.

The *pelvis* in its general form closely resembles that of *Oreodon*. The ilium is prolonged in front of the acetabulum somewhat more than the ischium is behind it, the disparity in length between the two bones being about equal to that seen in *Oreodon*. It is considerably expanded, and its anterior inferior angle is produced into a prominent hook-shaped spine. The narrow contracted portion, just in advance of the acetabulum, is of moderate length, and the transition into the expanded portion is more gradual than in *Oreodon*, where it is quite sudden. In the pig, deer and sheep, the concavity of the ilium is divided into a superior and an inferior portion by a longitudinal ridge, which terminates at the anterior border in a well-marked tuberosity. No trace is seen of this in the camel, as is also the case in *Agriochœrus* and *Oreodon.*

The ischium, again, resembles that of *Oreodon* more closely than any form with which I have compared it. Its posterior border is thin and of considerable vertical depth, passing by a well-rounded border into the pubis below. It, however, exhibits three thickenings, one of which is superior, one posterior, and one inferior. In the pig the ischium terminates posteriorly in a stout trihedral bar of bone, which is directed upwards at a considerable angle. The plate which bounds the obturator foramen posteriorly, however, exhibits a considerable thickening upon its lower edge. In the sheep, camel and deer, the ischium has near its posterior termination a stout transverse spur projecting outwards; in the camel the ischial tuberosity is at the base of the spur, while in the sheep and deer it is considerably behind its base. *Agriochœrus*, therefore, resembles the pig more in this respect than any of the Selenodonts.

The pubis is short and rather weaker than in *Oreodon.* The ileo-pectineal eminence is well marked, and the pubic symphysis short; the obturator foramen is of moderate size and has an oval form. The acetabulum is deep, and the cotyloid notch is rather wide and backwardly directed.

Of the *femur*, the head is very globular and is more exserted from the neck than in any of the recent Artiodactyla. The great trochanter does not rise as high as the top of the head of the bone, the digital fossa is deep, and the intertrochanteric line rather indistinct. The neck is rather more elongated than in recent forms, and the whole proximal end of the femur has rather more of a carnivorous than ungulate appearance. The shaft is nearly straight, almost circular in section, and displays but a faint development of the *linea aspera*. The distal extremity has considerable antero-posterior extent, and does not exhibit the fore and aft flattening noticed by Professor Osborn and myself in our

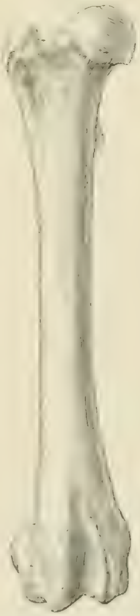

Fig. 17. Femur of *Agriochœrus latifrons*. One-third natural size.

original description. A comparison of the original specimen with our present material shows that this feature of the distal end of the femur was altogether due to crushing, and does not represent the natural shape of this part of the bone. The whole distal extremity rather closely resembles that of *Oreodon*, the differences being of comparatively little importance.

Tibia and Fibula.—The latter of these bones is represented in the collection by only its articular extremities, so that a complete description cannot be given. The head of the tibia presents the usual Artiodactyle pattern, and differs little from that of *Oreodon*, the sheep or camel. The shaft is relatively more slender and elongated than that of *Oreodon*, and the cnemial process is not extended so low down. The remainder of the description of the two bones I take from our original statement :

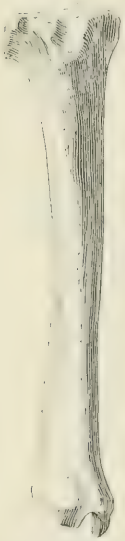

Fig. 18. Tibia of *Agriochœrus guyotianus.* Two-fifths natural size.

" The internal malleolus is remarkable for its development and the manner in which it articulates with the astragalus. It is long, stout, and slightly hook-shaped, reaching at least half-way down the inner side of the astragalus when the bones are placed in position. The hook is directed to the outer side of the ankle, and is received into a deep excavation upon the inner face of the ankle bone. In the pig the internal malleolus is small and overlaps the inner side of the astragalus but slightly, but in *Oreodon* it is much larger and overlaps the astragalus considerably. It also has a tendency to become hook-shaped in this form. The remainder of the articular surface is shaped very much as in the pig, being deeply grooved to receive the condyles of the astragalus, with a median tongue or ridge which fits accurately into the intercondylar groove of this latter bone.

" The shaft of the fibula, so far as it is preserved, is slender and much flattened. Its distal extremity is expanded to a greater extent than in the pig, and, as in all the Artiodactyla, it articulates with both the astragalus and calcaneum. The articular surface, by means of which it joins the astragalus, consists of a beveled edge upon the upper outer surface of the external condyle of this bone, anteriorly. In the Artiodactyla, owing to the vertical dimensions of the astragalus, the fibula overlaps it considerably, so that the articulation between these two bones is confined entirely to the outer side of the astragalus.

"*Tarsus.*—The tarsus presents so many striking resemblances to that of the Artiodactyle Ungulates that its description is perhaps best accomplished by instituting a comparison between it and some generalized members of this order, of which the pig is a good example.

"The *astragalus* is relatively broader and of less vertical depth than that of the boar. This results from the shortness of the neck and the inward extension of the navicular portion of the head. Its superior or trochlear surface presents two unequal condyles, strongly convex from before backward, and separated by a deep groove. The external condyle, the larger of the two, is limited in front by a deep transverse notch which separates it sharply from the cuboidal facet, in front or below. This notch is much more pronounced than in the astragalus of the pig. The inner condyle is smaller and presents a somewhat sharper crest, owing to the excavation of its inner side for articulation with the internal malleolus. In its lower or anterior extremity it is well rounded, and of a somewhat scroll-like pattern, terminating abruptly in a distinct overhanging ledge, which separates it from the navicular facet. This ledge is absent from the astragalus of the boar, as is also the scroll-like appearance of the lower part of the condyle, but traces of it are to be seen in *Oreodon.* The distal extremity or head of the astragalus is occupied by two facets for articulation with the cuboid and navicular. It joins the trochlear portion by a short neck, and is placed quite as obliquely upon this part of the bone as in that of the suillines. The cuboid and navicular facets are strongly convex from before backwards, and in their articulation with these bones form as perfect a ginglymus as is to be seen in any of the Artiodactyla. They are sharply separated from each other by a prominent fore and aft ridge, which passes backwards to form the inner boundary of the sustentacular facet behind. The cuboid facet is the smaller of the two, and can be said to have but a limited extension backwards. It narrows greatly at the middle of the under or anterior surface, and become continuous with the sustentacular facet behind. In the pig, and to a somewhat less extent in *Oreodon*, it is continued well around to the posterior surface, but it is separated from the sustentacular facet by a well-marked ridge. This facet, while it is strongly convex from before backwards, is little or not at all concave from side to side. The navicular facet on the other hand is not only very convex fore and aft, but presents first a convexity and then a marked concavity laterally from within outwards, as in the pig. One feature in which it differs markedly from the astragalus of the pig, and for that matter, of all the Artiodactyla, is its great backward extension, reaching as far as the middle of the posterior surface of the bone. By reason of this backward extension of the navicular facet, the facet for the *sustentaculum tali* is very oblique and beveled considerably externally. It covers the larger part of the posterior surface of the bone.

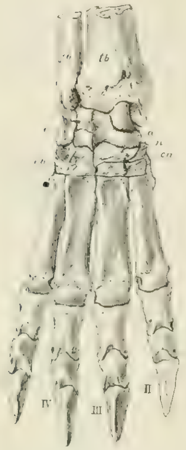

Fig. 19. Hind foot of *Agriochœrus major.* Front view.

" The *calcaneum* resembles the corresponding bone of the pig very closely. This is especially noticeable in the small sustentaculum, the narrow distal extremity where it articulates with the cuboid, together with the prominent articular face by which it articulates with the fibula. As compared with that of the pig, the tuber is relatively shorter, the distal end is somewhat narrower, and the fibular facet has a greater antero-posterior extent. Upon the outer side just below the fibular facet is a prominent bony ridge for the attachment of the external lateral ligament, beneath which is a shallow fossa, which is scarcely indicated in the calcaneum of the boar. Upon the end of the tuber is seen a well-marked groove, located somewhat to the inner side, which serves for the passage of the tendon of the *plantaris* muscle.

" The *cuboid*, as compared with that of the pig, is much depressed. Posteriorly it bears a process of moderate dimensions as in the Artiodactyla in general. Upon its upper surface are the two facets for the calcaneum and astragalus, that for the calcaneum being almost flat and inclined downwards and forwards, while the astragalar facet is strongly concave. Distally two facets can be distinguished for articulation with the fourth and fifth metapodials respectively. They are relatively broad and flat. At the posterior edge of these articular surfaces, immediately beneath the backwardly projecting bony process, is to be seen a slight groove for the passage of the long peroneal tendon as it crosses the plantar surface of the foot. This groove is especially well developed in the pig, being almost completely converted into a foramen. In *Oreodon* it is less developed.

" The *navicular* is also much flattened from above downwards, resembling in this respect the corresponding bone of the Perissodactyla, rather than that of Artiodactyla. It is strongly cupshaped above to receive the convex navicular portion of the head of the astragalus, and much flattened below where it articulates with the coössified ecto- and meso-cuneiforms. Upon its inner face is seen a moderately weak *tuberculum*, to which the tendon of the anterior tibial muscle (*tibialis anticus*) is attached. Its chief peculiarity is found, however, in the enormous hook which is developed upon its posterior surface. This hook is broad, much flatttened from behind, and completely overhangs the ecto-meso-cuneiform, as well as the proximal ends of the neighboring metapodials. Although less prominent it appears to be universally present in the Artiodactyla and as universally absent in the Perissodactyla.

" *Features of the Double Ginglymus.*—It is interesting to note in this connection, and a matter of no slight significance, that a similar hook is developed upon the navicular of the lagomorph rodents. In this widely separated group we also find that the foot is of the paraxonic type, that the fibula articulates with the calcaneum, and that there is a distal ginglymus present (astragalo-navicular). It would thus appear that these characters, arising as they have independently, in at least two distinct and widely separated orders, are necessary concomitants, and dependent upon the same or similar causes for their production.

"The *ecto-* and *meso-cuneiforms* are completely coössified, there being no trace of the suture visible. This compound bone is broad and flat, and rests upon the second and third metapodials. The articulation with these bones is by a broad flattened surface, which is also true of the articular surface by which it supports the navicular."

The ento-cuneiform is a long slender styliform nodule articulating by a double facet with the navicular and compound cuneiform ; upon its anterior internal face is seen another elongated facet by which it joins the posterior surface of the head of the second metatarsal. When in place, it lies anterior and internal to the navicular hook. In our original description we erroneously supposed that a hallux was present, but our present material shows that this bone did not support a metatarsal. The hallux was therefore absent. The general shape and connections of the bone are similar to that of *Oreodon.*

The Metatarsus.—"Of the metatarsals, the two median ones, mts. III and IV, are almost if not quite equal in size and length. The lateral ones, mts. II and V, are practically so, the disparity in their length being slightly greater than that found in the pig. While the outer one (mt. V) is a little the longer of the two, the inner one (mt. II) is the stronger. This appears also to be true of all the more generalized Artiodactyla in which four toes are present. In the rabbit, on the other hand, mt. II, is both longer and stronger than mt. V, and this is also true of the median pair, the inner one slightly exceeding its fellow in size and length.

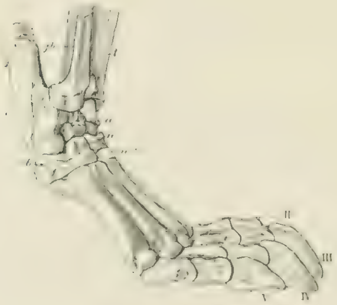

Fig. 20. Hind foot of *Agriochœrus major.* Side view.

"The two outer metatarsals (IV and V) are supported wholly by the cuboid, while the two inner ones (II and III) are supported by the compound cuneiform. Just as in the lower

Artiodactyla and in the rabbit there is no tendency to displacement of any of the metapodials. The distal ends of the metapodials have prominent well-rounded articular heads, very similar to those of the digitigrade Carnivora. These facets are continued well backward upon the dorsal surface, and are constricted off from the shafts by deep grooves, indicating that the main flexure of the foot took place at this point, as figured by Gaudry in *Chalicotherium*, and that the animal was truly digitigrade. Distal keels are present, but are confined to the plantar surface.

"*The Phalanges.*—The proximal phalanges are quite remarkable for the character of the articular surfaces by which they join the metapodials. When looked at from the side these surfaces are seen to be directed more upwards than backwards, almost to the same extent as represented by Gaudry in *Chalicotherium*. This indicates two things, viz.: that the proximal ends of the metapodials were raised from the ground, and that the distal end of the phalanx was carried slightly upwards when the bones were placed in their natural position. This view is further carried out by the character of the articular surface at the distal end of the phalanx. It is directed more downwards than forwards, which would give the succeeding phalanx a downward trend again, so that the first two phalanges would describe a gentle curve. This is well exemplified in the cat. The second or median phalanges are shorter than the proximal, and are more compressed from side to side. Distally they exhibit a grooved articular surface almost equally divided between the upper and lower moieties of the bone, for articulation with the large compressed claws or ungues. There is nothing to indicate that the ungues were strongly bent down upon the middle phalanx, as represented by Gaudry. If one can imagine a digitigrade bear it would come very near representing the manner in which the phalanges were articulated in *Artionyx* [*Agriochœrus*].

"The ungues are large, strongly compressed, and considerably arched upon the dorsal surface. They are a little hook-shaped. The proximal ends are deeply excavated (representing almost a semicircle), to receive the distal ends of the median phalanges. There is no trace of a bony sheath or median cleft developed."

The foot described above is from the larger species of the Protoceras Beds. In the smaller *A. latifrons* from the lower beds the foot is longer, more slender; the phalanges are considerably longer and resemble those of the fore foot.

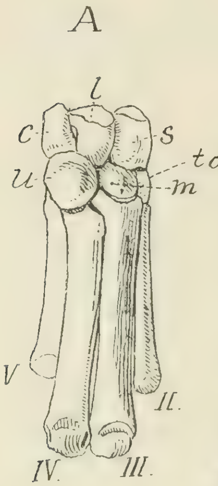

Fig. 21. Fore foot of *Merychyus.* After Scott.

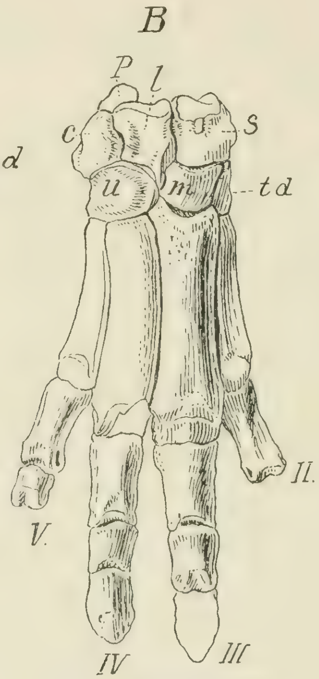

Fig. 22. Fore foot of *Merycochœrus.* After Scott.

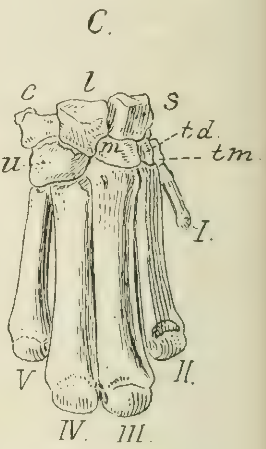

Fig. 23. Fore foot of *Oreodon.* After Scott.

SUMMARY OF COMPARISON WITH OREODON.

In the foregoing description I have compared the bones of *Agriochœrus* very closely with those of *Oreodon*, and it now remains to summarize the likeness and differences. *Agriochœrus* resembles *Oreodon* in the following important characters: (1) The upper canines are enlarged and have the distinctive D-shaped pattern on cross section. (2) The first lower premolar is enlarged and caniniform, the lower canine being incisiform. (3) The form of the skull is practically the same, and the foramina have nearly the same arrangement. (4) In the fore limb the scapula, humerus, ulna and radius are very similar in the two genera. (5) The lunar has a prominent downwardly projecting beak which excludes the magnum from contact with the unciform in front. (6) Both have five digits in the manus. (7) In the hind limb the pelvis, tibia and fibula are similar, as is also the case with tarsus. (8) The ecto- and meso-cuneiforms are united.

Agriochœrus differs from *Oreodon* in the following characters, which may be regarded as of equal importance: (1) Loss of incisors in *Agriochœrus*. (2) Molariform pattern of the fourth superior and inferior premolars, and the presence of a diastema in both jaws. (3) The molars are very different in structure. (4) The neural spine of the axis is different, and the transverse processes of the atlas are perforated. (5) There is a double tongue and groove articulation of the lumbar vertebræ. (6) The lunar rests largely upon the magnum instead of upon the unciform. (7) The trapezium does not touch the scaphoid. (8) The pollex has an opposable position and saddle-shaped articular facet. (9) The terminal phalanges are claw-like and not hoof-like.

COMPARISON WITH THE ANOPLOTHERIDÆ.

In many of its osteological features *Agriochœrus* resembles the Anoplotheroids. This is seen in the form of the skull, in the humerus, ulna and radius, as well as in the pelvis, femur, tibia and fibula. A very distinctive resemblance to *Agriochœrus* is seen in the molariform fourth premolars of *Dichodon cuspidatus*, while the only approach to the claw-like terminal phalanges is seen in *Diplobune*. Zittel says of them:[1] "Die Endphalangen zeichnen sich durch schmale, seitlich zusammengedrückte, gekrümte, fast Krallenartige Beschaffenheit aus." Another very marked peculiarity of this genus is seen in the way in which the lunar rests almost wholly upon the magnum, and has also a lateral contact with the unciform, just as in *Agriochœrus*. This resemblance between the two forms is further strengthened by the presence of the peculiar beak-like process which wedges in between the magnum and unciform. In the drawing given by

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[1] 'Handbuch der Palæontologie,' p. 373.

Zittel the magnum and unciform are represented as being in contact, with the lunar very loosely articulated. It is probable that if a closer fit of these bones were made the unciform and magnum would be separated in front.

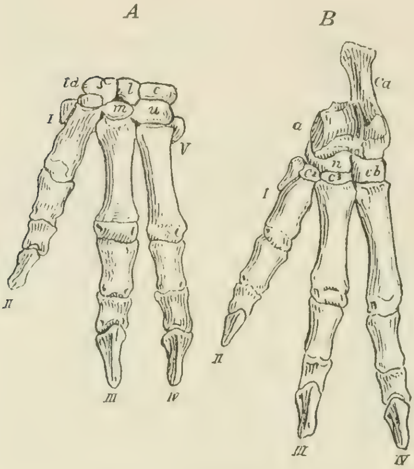

Fig. 24. Fore foot of *Diplobune*. After Zittel

Notwithstanding the resemblances to *Agriochœrus* to be found in these various members of this family, there are at the same time many well-marked differences. The upper canine of the Anoplotheroids is but little elongated, and does not have the characteristic D-shaped pattern on cross section ; the first inferior premolar is not caniniform, and the molars have a large and distinct anterior intermediate cusp. The ecto- and meso-cuneiforms are always distinct, and the toes are reduced to two or three. In some instances the reduction of the digits and the elongation of the podial elements has gone almost as far as in any of the modern Pecora.

THE SYSTEMATIC POSITION OF AGRIOCHŒRUS.

In attempting to discover the more exact relationship of *Agriochœrus*, I think we may safely assume, from what has already been said, that it is a member of the Artiodactyla. We can furthermore exclude the Suillines as being little or no nearer to it than the original or common ancestor of the whole group. There can be little doubt that the Selenodonts early split into two divisions, of which one retained the anterior intermediate cusps of the molars, while the other kept the posterior intermediate cusps. In the higher development of each of these lines the intermediate cusps disappeared, leaving a tetraselenodont molar. According to

Schlosser it was the latter of these lines which gave origin to the modern Selenodonts, while the former became entirely extinct. It is possible, however, that the camels represent an independent off-shoot.

In *Agriochœrus* the molars are tetraselodont, and until we know more of its ancestry it is impossible to say with certainty from which of the two lines it has descended. If, however, we can form any judgment from the great similarity of its skeletal structure with that of the group with the anterior intermediate cusp in the superior molars, viz., the Oreodonts, Anoplotheroids and Anthracotheroids, then we must conclude that its nearest affinities are with these forms. There is one character that opposes itself to this view, and that is the opposable position of the pollex. We probably know the direct ancestors of the true Oreodonts in *Protoreodon* of the upper Eocene, and according to Scott,[1] there is no hint of this position of the pollex seen in the manus of this form. While it tends in a measure to bridge over the differences between *Agriochœrus* and *Oreodon*, it nevertheless is much nearer to the latter than the former in all of its essential characters. The terminal phalanges are quite as distinct hoofs as are those of *Oreodon*, and the scaphoid is high and narrow. The relationship of the lunar to the surrounding bones is also decidedly more oreodont than agriochœrid.

Before we can understand the meaning of the peculiar position of the lunar in *Agriochœrus* it is necessary for us to know what the original arrangement of the carpal bones was in the Artiodactyla. Cope has shown that the arrangement in *Phenacodus* was serial, and he believes that this was the original position of the carpal elements in all the Ungulates. This it may be said is not at all an improbable view, and there is much evidence to support it. Now if this were the case in the ancestors of the Artiodactyla, then we must look upon the Oreodonts as an extreme form in which the lunar has shifted almost completely from the magnum across upon the unciform. In fact, *Protoreodon* furnishes us with very strong presumptive evidence that this is true, for in this ancestral form we find the lunar with a much larger contact with the magnum. *Agriochœrus*, on the contrary, is yet more primitive in that the lunar has made but a slight advance upon the unciform.

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[1] Mammalia of the Uinta Formation, pp. 496–499.

I cannot see that there is any evidence whatever to support the view expressed by Scott,[1] that the lunar of *Agriochœrus* originally rested equally upon the unciform and magnum, and later shifted to the radial side so as to rest almost wholly upon the magnum. The much more probable view, it seems to me, is that *Agriochœrus* is more primitive in this respect than either *Oreodon* or its ancestor *Protoreodon*, and that the lunar, as well as the other bones of the proximal row, had just begun to shift towards the ulnar side. This is a conceivable explanation of the opposable position of the pollex.

Regarding this latter character of *Agriochœrus*, it may be said that it is the only instance of its kind known among the Ungulata. While it is true that the pollex was to a large extent functionless in this Miocene representative, yet at the same time it raises some interesting questions. Is it possible that the remote ancestors of the Artiodactyla had opposable thumbs, and that they were more or less arboreal in habit; or are we to suppose that the position of this digit came to be more or less opposable as a consequence of and during its progressive atrophy? We know of no analogous instance within the whole range of the mammalia. It is hardly conceivable that the thumb could have at first had a position in line with the other digits, then became opposable, and finally reverted to its original condition. Did these characters stand alone I would be tempted to regard them lightly, and as of comparatively little importance, but it must not be forgotten that we have associated with them the remarkable form of the ungual phalanges. The meaning of all this may be more profound than one would perhaps be led to consider after a hasty review. That *Agriochœrus* displays many striking resemblances in the structure of its skeleton to the group already mentioned, there can be no question, but before we construct its phylogeny, and finally determine its position, I think it would be wise to wait until we know a little more of the forms that went before.

The Species of Agriochœrus.

The genus *Agriochœrus* was originally described by Leidy[2] as representing a distinct family. This author referred three species to it, all of which were from the White River Miocene deposits of Dakota. Subsequently Cope added three more species from the John Day beds of Oregon, together with another genus under the name of *Coloreodon*, to which he referred two species from the same locality.[1] Within the past year Marsh has described a third genus under the name of *Agriomeryx* from the White River beds.[2] The only characters by which either *Coloreodon* or *Agriomeryx* is distinguished from *Agriochœrus* is the possession of three superior premolars, whereas the typical species have four. In our collection there are two skulls which agree in every particular with Leidy's description of *Agriochœrus latifrons*; in one skull there are three superior premolars upon each side, while in the other there are three upon one side and four upon the other. This character is therefore shown to be variable within the limits of a species, and cannot be used to define a genus. It may be that the three-premolar types have other characters of the skeleton which will separate them into a distinct genus, but as the evidence now stands the names of Cope and Marsh must be regarded as synonyms of the original genus *Agriochœrus*.

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[1] 'Notes on the Osteology of Agriochœrus,' Amer. Philos Soc., 1804, pp. 243-251.

[2] Proc. Acad. Nat. Sci. Philad., 1850, p. 121.

The following analysis of the species is somewhat modified after Cope.[3]

I.—Superior premolars, 4.

(*a*) Otic bullæ much inflated, ovoid, and produced in direction of long axis of skull; muzzle short and wide; internal wall of inf. Pm. 4 complete; frequently only three sup. premolars; Oreodon beds, White River.............................*A. latifrons* Leidy.

(*b*) Otic bullæ less inflated, more or less quadrate in outline and elongated in same direction as last species; muzzle longer and narrower; internal wall of inf. Pm. 4 not complete; sup. Pms. always 4; Oreodon beds, White River...............*A. antiquus* Leidy.

(*c*) Otic bullæ small, more or less mammiform, triangular in outline, not reaching below point of postglenoid from which it is widely separated, and with large anteriorly projecting process in front at junction with skull; muzzle relatively long and narrow; internal wall of inf. Pm. 4 complete; nasals pointed posteriorly. John Day beds..........................*A. guyotianus* Cope.

(*d*) Otic bullæ proportionately much larger than in last species, greatly flattened in front and projecting much below point of postglenoid, which it joins internally; muzzle short, broad and concave above. John Day beds...........................*A. trifrons* Cope.

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[1] Proc. Amer. Philos. Soc, 1879, p. 375.

[2] 'Description of Tertiary Artiodactyles,' Amer. Jour. Sci., 1894, Vol. XLVIII, p. 270.

[3] 'Synopsis of the Species of Oreodontidæ,' Proc. Amer. Philosoph. Soc., 1884, p. 503-572.

(*e*) Otic bullæ large, quadrate in outline, very obliquely directed and constricted in the middle; muzzle broad, flattened above; nasals trucate posteriorly; postglenoid robust. John Day beds. *A. ryderanus* Cope.

II.—Superior premolars, 3.

(*a*) Species large; otic bullæ greatly inflated, ovoid, and produced in direction of long axis of skull; nasals narrow and pointed behind; palatonareal border opposite anterior cusp of third molar. Protoceras beds, White River.................*A. major* Leidy.

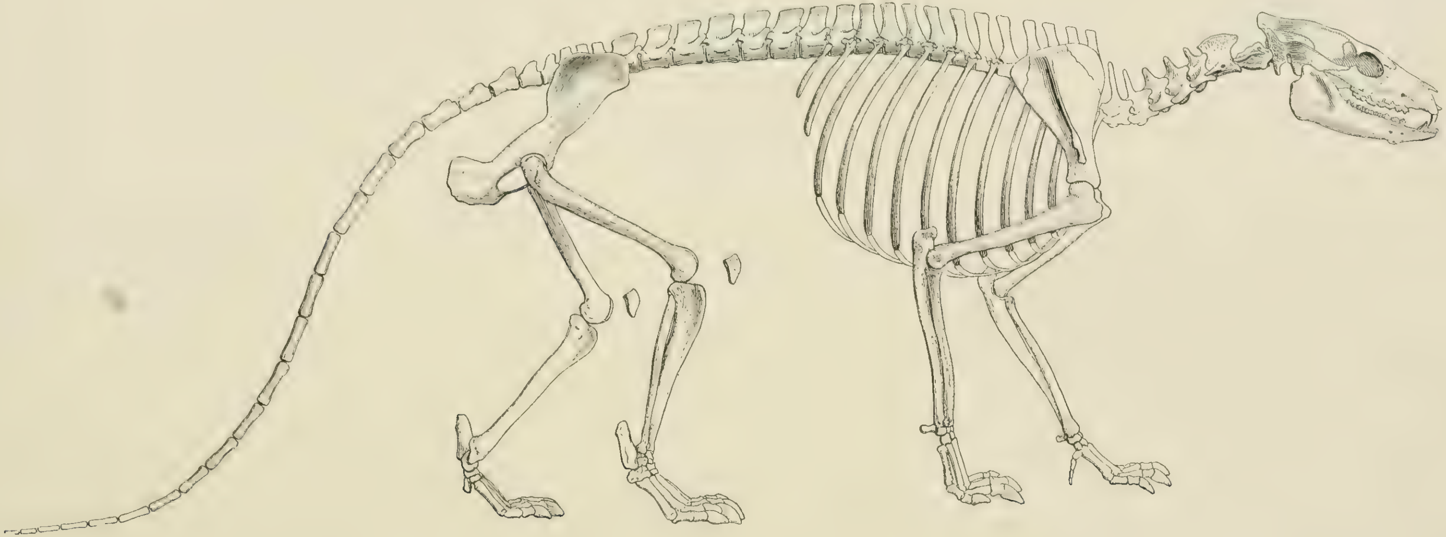
(*b*) Species large; otic bullæ unknown; palatonareal border opposite posterior cusp of third molar; sagittal crest posterior, commencing opposite preglenoid border. John Day beds. *A. macrocephalus* Cope.

(*c*) Species small; otic bullæ unknown; palatonareal border opposite posterior cusp of second molar; sagittal crest anterior, commencing opposite optic foramen. John Day beds.... *A. ferox* Cope.

There is a large species found in the Oreodon beds of the White River formation which I have not been able to identify with certainty on account of lack of material; this may yet prove to be Leidy's *A. major* when more complete material is obtained; it will then probably become necessary to recognize another species from the Protoceras layer, which I have here called *major*. If this supposition is correct the large species from the upper beds would take the name of *A. gaudryi*, which Osborne and myself have already described.

The succession of the species is natural and easy as we pass from the lower to the upper beds. *A. latifrons* from the Oreodon beds of the White River stands in direct ancestral relation with *A. major* of the Protoceras beds. This is especially seen in the character of the bullæ and the disposition to discard one of the superior premolars. From this three-premolar type we pass by easy steps to *A. macrocephalus* and *A. ferox* of the later John Day horizon. In like manner the four-premolar type with the long narrow muzzle and comparatively little inflated otic bullæ, *A. antiquus*, begins low down in the White River. This form was undoubtedly the progenitor of *A. guyotianus* and its relatives of the John Day.

My especial thanks are due to Professor Marsh for the opportunity of examining his beautiful material relating to the earlier Eocene Artiodactyla, as well as to Professor Scott for the loan of specimens.



RESTORATION OF *Agriochœrus latifrons.*

About one-eighth natural size.

Article V.—ON THE NAMES OF MAMMALS GIVEN BY KERR IN HIS 'ANIMAL KINGDOM,' PUBLISHED IN 1792.

By J. A. ALLEN.

In May, 1791, Robert Kerr, F.R. & A. SS. E., etc., issued a prospectus of an English translation of "The Systema Naturæ of Linnæus, as lately published, by the learned Professor Gmelin of the University of Gœttingen," with numerous additions "from the writings of such Zoologists, Voyagers, and Travellers, as had not fallen under the observation, either of the great Linnæus, or of his excellent successor." It was proposed to publish the work in parts, to form, when completed, four quarto volumes. The "first half-volume" was brought out in 1792, the preface to which (from which the above information is derived) bears date "February, 1792." Part 1 of Volume I comprises "the class of Mammalia"; Part 2 begins the class of Birds, but ends abruptly (in the only copy I have seen) at p. 644, in the midst of the genus *Corvus*. Whether any more was published I am unable to state, but the work was not only discontinued at an early stage, but only a small edition of the part relating to the Mammalia appears to have been issued, it being a very scarce publication, and one which has been rarely cited by subsequent authors.[1]

Part I has the following title-page:

The | Animal Kingdom, | or | Zoological System, | of the celebrated | Sir Charles Linnæus ; | — | Class I. | Mammalia : | containing | a complete Systematic Description, Arrangement, and Nomencla- | ture, of all the known Species and Varieties of the Mammalia, | or Animals which give suck to their young ; | being a translation of that part of the | Systema Naturæ, | as lately published, with great improvements, | By Professor Gmelin of Goettingen. | — | Together with | numerous additions from more recent zoological writers, | and illustrated with copperplates : | — | By Robert Kerr, F. R. & A. SS. E., | member of the

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[1] The copy in hand is the property of the Boston Society of Natural History, for the temporary loan of which I am indebted to the Secretary of the Society, Mr. Samuel Henshaw. It was presented to the Society by the late D. H. Storer, M.D., in 1865.

Royal College of Surgeons, and of the Royal Physical Society, | and Surgeon to the Orphan Hospital of Edinburgh. | — | London : | Printed for J. Murray, No. 32, Fleet-street ; | and | R. Faulder, No. 42, New Bond Street. | — | 1792. 4to, pp. i-xii, ll. 14, pp. 1-400, pll. i-vii.

Pages v–xii contain 'To the Public,' followed by a 'Systematic Catalogue of the Mammalia,' occupying 14 unpaged leaves. Then follows a free translation of Gmelin's 'Systema,' with extended interpolations, including several new genera (or subgenera—these groups are treated in both senses in different parts of the work), and a large number of supposed new species and varieties.

An important part of the work, from a nomenclatural point of view (and a part easily overlooked and not easy of citation), is the 'Systematic Catalogue of the Mammalia,' occupying the 14 unpaged leaves following the author's address to the public. According to the marginal numbers, the work treats formally of 808 species and varieties of mammals (not including domesticated varieties), of which about 250 are additional to those given by Gmelin. Most of the technical names by which they are designated are here published for the first time, but some are from Pallas, Erxleben, and other early authors,[1] overlooked or ignored by Gmelin.

In the main Kerr's work, considered as a compilation (which it purely is), is creditable for its time, displaying much research and a fair appreciation of his subject. Unfortunately he yielded to the temptation of naming everything mentioned, however vaguely, by previous authors, including scores of albinistic and melanistic phases of well-known species. His names, however, all require consideration, from the fact that names once employed are preoccupied for use later in other connections. Scattered through this nomenclatural chaff are names of many valid species, here first formally introduced into zoölogical nomenclature. These include a considerable number of Australian mammals described and figured by Governor Phillip in his 'Voyage to Botany Bay' (1789) under merely vernacular names, as well as many gleaned from other trustworthy sources. Many of these names have gradually come into use (mostly in recent years), but they have often been attributed (especially formerly) to Turton,[1] Shaw or other writers; others have been wholly overlooked,[2] including several generic names, many specific names, and a large number of varietal names. As Kerr's names cannot be ignored, the sooner they are brought to light the better, in the interest of ultimately reaching a stable nomenclature.

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[1] In most cases Kerr, in his citations, gives no clue to their origin.

The present investigation was begun with the purpose of treating only such names as relate to North American mammals. Later the scope was extended to embrace such other names as evidently had an important bearing upon the nomenclature of exotic species. Finally it was decided to include all of Kerr's names not obviously founded on albinistic or melanistic conditions, or upon hybrids and varieties due to domestication.

GENERIC NAMES.

Kerr's new generic (or subgeneric) names are:

Sapajus=*Cebus* Erxleben, 1777.

Sagoinus=*Callithrix* Erxleben, 1777.

Sukotyro—apparently a fabulous beast, mentioned by the traveller Nieuhoff.

Lynx=*Lynx* Rafinesque, 1818.

Myocastor=*Myopotamus* Geoffroy, 1805. Type, by elimination, *Myocastor coypus*.

Cricetus=*Cricetus* Cuvier, 1817.

Myotalpa. By elimination=*Siphneus* Brants, 1827. Type, *Mus talpina* Pall.

Of these seven genera, two *Sapajus* and *Sagoinus*, are respectively almost pure synonyms of *Cebus* and *Callithrix* of Erxleben, and are hence untenable as used later in a restricted sense by Lacépède (1803). A third, *Sukotyro*, has no status, having a mythical basis, as shown by Kerr's description and figure. Two others, *Lynx* and *Cricetus*, are in current use, but wrongly accredited to later authors. The remaining two, *Myocastor* and *Myotalpa*, must supplant later names that have long been in current use.

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[1] Turton's translation of Gmelin's 'Systema Naturæ,' in seven octavo volumes, under the title 'A General System of Nature,' etc. (Vol. I, Mammals, Birds, Amphibia, and Fishes, 1806) is mere trash in comparison with Kerr's work. In Turton's translation, "amended and enlarged by the improvements and additions of later naturalists," all references to previous writers are systematically and purposely omitted, "as," says the author, "they would so considerably have enlarged the bulk of the work, without adding a proportional value." On the other hand, Kerr gives at least references to the authors on which his names are based, though failing to indicate, as a rule, whether the names additional to those employed by Gmelin are his own or from Schreber, Erxleben, Shaw, Pallas, or other preceding writers. Apparently Turton (fortunately) imposed very few new names, but copied nearly all of Kerr's, which, owing to the scarcity of Kerr's work, have been largely credited to Turton. To distinguish the names really given by Turton hence requires familiarity with the writings of preceding authors.

Shaw also rarely cites Kerr, even when using Kerr's names. Most of the names from Kerr, duly accredited prior to 1876, are the few cited by Shaw in his 'General Zoölogy' (1800–01).

[2] Mr. Oldfield Thomas has brought to light and established many of Kerr's names which had escaped previous writers (cf. especially, Ann. and Mag. Nat. Hist., (5) IV, 1879, pp. [illegible] and his British Museum 'Catalogue of the Marsupialia and Monotremata' (1888). I have cited such as relate to the Pinnipedia (Mon. N. Am. Pinnipeds, 1880), the Cetacea (Bull. U. S. Geol. Surv., VI, No. 3, 1882), and the North American Sciuridæ and Muridæ.

The status of the four tenable generic names of Kerr may be shown as follows :

Genus **Lynx** *Kerr.*

Lynx KERR, Am. King. I, 1792, Syst. Cat. Nos. 288–299, and p. 41, 155.

The genus *Lynx*, commonly attributed to Rafinesque (Am. Month. Mag., I, Oct., 1817, p. 437, and *ibid.*, II, Nov., 1817, p. 46), was instituted by Kerr in 1792. It forms his second division of Felis, and is characterized as follows :

"** LYNXES. *Lynces.*

"With short tails, and pencilled ears."

It contains nine species and three subspecies, namely :[1]

"288. Caspian Lynx.	1. Lynx Chaus.
289. Mountain Lynx.	2. Lynx montana.
290. Persian Lynx.	3. Lynx Caracal.
291. Bengal Lynx.	4. Lynx bengalensis.
292. Booted Lynx.	5. Lynx nubiensis.
293. Barbary Lynx.	6. Lynx lybiensis.
294. Common Lynx.	7. Lynx vulgaris.
295. White Lynx.	β. Lynx vulg. alba.
296. Yellow Lynx.	γ. Lynx vulg. melina.
297. Thibet Lynx.	δ. Lynx vulg. maculata.
298. Canadian Lynx.	8. Lynx canadensis.
299. American Lynx.	9. Lynx rufa."

In the body of the work (pp. 155–158), where the species are formally described, the name *Lynx* is combined with *Felis*, *e. g.*, *F.*[*elis*] *Lynx canadensis* = *Felis* (*Lynx*) *canadensis.*

Genus **Myocastor** *Kerr.*

In his 'Systematic Catalogue of the Mammalia,' Nos. 458–521, Kerr divides the "Murine Quadrupeds" (=Muridæ) as follows :

* Beaver Rats. *Myocastores.*
** Rats and Mice. *Mures.*
*** Hamsters. *Criceti.*
**** Mole-Rats. *Myotalpæ.*

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[1] From his 'Systematic Catalogue,' not paged.

The Beaver-Rats include two species only—(1) "Webbed Beaver-Rat, *Myocastor Coypus*"; (2) "Musquash, *Myocastor zibethicus*." As Cuvier, in the year 1800, instituted the genus *Fiber* for the Muskrat, only the Coypu was left in the genus *Myocastor*, which thus became its type by elimination. Hence the genus *Myopotamus* Geoffrey (1805), based on the Coypu, and since in current use, must be treated as a synonym of *Myocastor* Kerr.

Genus **Cricetus** *Kerr.*

Cricetus KERR, An. King. I, 1792, Syst. Cat. Nos. 509-515, and pp. 42, 242-246.

The name *Cricetus*, usually attributed to Cuvier (1817), was used by Kerr for a division of his 'Murine Quadrupeds'—in a generic sense in his 'Systematic Catalogue,' and in a subgeneric sense in the body of the work. The species included under *Cricetus* are the following:[1]

1. **Cricetus acredula**=*Mus migratorius* Pall. (1771)=*Mus accedula* Pall. (1778).
2. **Cricetus germanicus**=*Mus cricetus* Linn.
   β. **Cricetus germ. niger**=*Mus cricetus niger* Schreber.
3. **Cricetus arenarius**=*Mus arenarius* Pall.
4. **Cricetus phæus**=*Mus phæus* Pall.—type of *Cricetulus* Milne-Edw. (1867).
5. **Cricetus songaricus**=*Mus songaricus* Pall.
6. **Cricetus furunculus**=*Mus furunculus* Pall.

Genus **Myotalpa** *Kerr.*

Myotalpa KERR, An. King. I, 1792, Syst. Cat. Nos. 516-521, and p. 246.

Kerr gives a short diagnosis (l. c., p. 246) of *Myotalpa*, and adds in a foot-note: "The animals of this subdivision of the genus [*Mus*] are named *Mures subterranei*, by Dr. Gmelin; but the word *Myotalpa* is preferred in this edition, as being better adapted for the purpose of a subgenus."

Myotalpa is thus explicitly proposed in a subgeneric sense, but in the 'Systematic Catalogue' is used in generic name, as follows:

1. **Myotalpa talpina**=*Mus talpinus* Pall. Type of *Ellobius* Fischer, 1814.
   β. **Myotalpa talpina nigra**=*Mus talpinus* Pall, in part.
2. **Myotalpa capensis**=*Mus capensis* Pall. Type of *Georychus* Illiger, 1811.

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[1] Syst. Cat., Nos. 509-515.

3. **Myotalpa maritima**=*Mus suillus* Schreb. (1787)=*Mus maritimus* Gmel. (1788). Type of *Bathyergus* Illiger, 1811.
4. **Myotalpa aspalax**=*Mus aspalax* Pall. (1788)=*Mus myospalax* Laxmann (1773). Type of *Siphneus* Brants, 1827.
5. **Myotalpa typhla**=*Spalax microphthalmus* Gülden. (1770) (gen. et sp. nov.).

The last species enumerated under *Myotalpa* had already been made the type of a genus *Spalax*, and the other four have been successively raised to generic rank. As *Myotalpa* must be preserved it will have to stand, by the rule of elimination, for the species last removed from *Myotalpa*, namely, *Myotalpa aspalax*. *Siphneus* of Brants thus becomes a synonym of *Myotalpa* Kerr (restricted).

It also appears that *Bathyergus maritimus* (Gmel.) Illiger should stand as *Bathyergus suillus* (Schreber),[1] as Schreber not only used this name on his Pl. cciv B, but in the page heading to p. 715.

Apparently, also, *Spalax microphthalmus* Güldenstædt (Nov. Comm. Petrop., XIV, 1770, p. 409, pll. viii, ix) has priority over *Mus typhlus* Pallas (Nov. Sp. Glires, 1778, pp. 76, 174, pl. viii). Hence the species commonly known as *Spalax typhlus* (Pall.) should stand as *Spalax microphthalmus* Gülden.

The species currently known as *Siphneus aspalax* (Pall.) Brants should not only take the generic name *Myotalpa*, as shown above, but *Mus aspalax* Pallas (Nov. Sp. Glires, 1778, pp. 76, 165, pl. x) is antedated by *Mus myospalax* Laxmann (Sibir. Briefe, 1769, p. 75); hence the name in full should be *Myotalpa myospalax* (Laxm.).

Kerr's five species of *Myotalpa* will thus stand as follows :

1. *Myotalpa talpina* (Pall.) Kerr, becomes **Ellobuis talpinus** (Pall.) Fischer.
2. *Myotalpa capensis* (Pall.) Kerr, becomes **Georychus capensis** (Pall.) Ill.
3. *Myotalpa maritima* (Pall.) Kerr, becomes **Bathyergus suillus** (Schreb.).
4. *Myotalpa aspalax* (Pall.) Kerr, becomes **Myotalpa myospalax** (Laxm.).
5. *Myotalpa typhla* (Pall.) Kerr, is **Spalax microphthalmus** Gülden.

SPECIES AND VARIETIES.

These are taken up in the order in which they stand in Kerr's work, and include all that seem entitled to consideration. The changes from current nomenclature are indicated by heavy-faced type.

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[1] *Mus suillus* SCHREBER, Säugeth. Th. IV, p. 715, pl. cciv B (circa 1787).
Mus maritimus GMELIN, Syst. Nat., I, 1788, p. 140 (cites Schreber, as above, and his references, and no others).

In some cases Kerr's names are here allocated on the basis of his references as currently synonymised by standard authorities, some of the works to which Kerr refers being inaccessible at the present writing.

Simia satyrus[1] pongo *Kerr*, No. 3=Anthropopithecus troglodytes (*Gm.*).

Simia satyrus jocko *Kerr*, No. 4=Simia satyrus *Linn.*

Simia lar minor *Kerr*, No. 6=Hylobates lar (*Gmel.*).

Simia lar argenteus *Kerr*, No. 7=? Hylobates lar (*Gmel.*).

Simia suilla *Kerr*, No. 10=Cynocephalus mormon (*Linn.*).

Simia (Papio) sylvicola *Kerr*, No. 17=Simia sylvicola *Shaw* (1800). Not determinable.

Simia (Papio) variegata *Kerr*, No. 18=Simia sublutea *Shaw* (1800). Not determinable.

Simia (Papio) cinerea *Kerr*, No. 19=Simia cinerea *Shaw* (1793)=? Simia leucophæa *F. Cuv.*

Simia (Papio) livea *Kerr*, No. 20=Simia dentata *Shaw* (1800). Not determinable.

Simia (Papio) cristata *Kerr*, No. 22. Not determinable.

Simia (Cercopithecus) hamadryas ursinus *Kerr*, No. 25=? Cynocephalus hamadryas (*Linn.*).

Simia (Cercopithecus) veter albibarbatus *Kerr*, No. 27=Simia ferox *Shaw* (1800)=Macacus silenus (*Linn.*).

Simia (Cercopithecus) silenus albibarbatus *Kerr*, No. 29=Kerr's No. 27, as above.

Simia (Cercopithecus) silenus tie-tie *Kerr*, No. 30. Not determinable.

Simia (Cercopithecus) silenus purpuratus *Kerr*, No. 31=Macacus silenus (*Linn.*).

Simia (Cercopithecus) æthiops torquatus *Kerr*, No. 39=Cercocebus collaris *Gray* (1843). Gray's *Cercocebus collaris* is identified by Gray himself with the *Mangabey à collier blanc* of Buffon, which is the sole basis of Kerr's *S.* (*C.*) *æthiops torquatus*. Hence, **Cercocebus torquatus** (*Kerr*).

Simia (Cercopithecus) aygula monea *Kerr*, No. 41. Not identifiable; not *Simia mona* Schreb.

Simia (Cercopithecus) nictitans barbatus *Kerr*, No. 43. Not determinable.

Simia (Cercopithecus) sinicus pileatus *Kerr*, No. 45=Simia pileata *Shaw* (1800). Hence, *Macacus pileatus* (**Kerr**).

Simia (Cercopithecus) ruber nigrofasciatus *Kerr*, No. 48 } =Cercopithecus
Simia (Cercopithecus) ruber albofasciatus *Kerr*, No. 49 } patas (*Schreb.*).

Simia (Cercopithecus) talapoin niger *Kerr*, No. 51. Not determinable.

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[1] Initials of specific names are here uniformly reduced to lower-case; Kerr generally employed capital initials for all substantives used for specific or varietal names.

Simia (Cercopithecus) nasuus *Kerr*, No. 55=Simia nasalis *Shaw* (1800)= "Simia nasica *Audeb.*" (circa 1800). Hence, **Nasalis nasuus** (*Kerr*). Kerr's name appears to have eight years' priority over either *nasica* or *nasalis*. The name *nasica* is sometimes wrongly attributed to Schreber.

Simia (Cercopithecus) capistratus *Kerr*, No. 56=Prude *Pennant*=? Nasalis nasuus (*Kerr*).

Simia (Cercopithecus) luteolus *Kerr*, No. 57=Simia flavescens *Shaw* (1800). Not determinable.

Simia (Cercopithecus) fulvus *Kerr*, No. 58=Simia fulva *Shaw* (1800)=Cercopithecus mulatta *Zimm.* (1780). Not determinable.

Simia (Cercopithecus) viridens *Kerr*, No. 59=A variety of Pennant's *Tawny Monkey*. Not determinable.

Simia (Cercopithecus) hircinus *Kerr*, No. 60=Simia hircina *Shaw* (1800)= Goat Monkey *Pennant*. Not determinable.

Simia (Cercopithecus) regalis *Kerr*, No. 61=Simia comosa *Shaw* (1800)= Cebus polykomos *Zimm.*=Colobus polykomos (*Zimm.*).

Simia (Cercopithecus) badius *Kerr*, No. 62=Simia ferruginea *Shaw* (1800)= Colobus temminckii *Kuhl* (1820). Hence, **Colobus badius** (*Kerr*).

Simia (Cercopithecus) fuscus *Kerr*, No. 63=Simia annulata (*Shaw*). Not determinable.

Simia (Sapajus) exquima *Kerr*, No. 67=L'Exquima *Buffon*=Cercopithecus diana (*Linn.*).

Simia (Sapajus) trepidus fulvus *Kerr*, No. 69=Sajou gris *Buff.*=Cebus griseus *Desm.* (1820)=Cebus apella (*Linn.*).

Simia (Sapajus) capucinus albulus *Kerr*, No. 73=Cebus hypoleucus *Humb.* (1811), et auct. Hence, **Cebus albulus** (*Kerr*).

Simia (Sapajus) variegatus *Kerr*, No. 77=Simia antiquensis *Shaw* (1800)= *Chrysothrix*, sp. Not determinable.

Simia (Sagoinus) jacchus moschatus *Kerr*, No. 80. Not determinable.

Lemur podje *Kerr*, No. 103=Le Tarsier *Buffon*=Lemur tarsier *Erxl.*= Tarsius spectrum (*Pall.*).

Lemur prehensilis *Kerr*, No. 104=Little Maucauco *Pennant*=Lemur murinus *Miller*=*Microcebus*, sp. ?

Vespertilio vampyrus helvus *Kerr*, No. 108=Lesser Rougette *Pennant*. Not determinable.

Vespertilio labialis *Kerr*, No. 115=Peruvian Bat, var. β, *Pennant*= ? Noctilio leporinus (*Linn.*).

Vespertilio pictus rubellus *Kerr*, No. 124=Striped Bat *Pennant*, in part= Kerivoula picta (Pall.).

Vespertilio cephalotes melinus *Kerr*, No. 129=Molucca Bat *Pennant*, in part=Harpyia cephalotes (*Pall.*).

Vespertilio americanus *Kerr*, No. 136=Clayton's Bat *Pennant*= ? Vespertilio americanus *Turton* (1806)=? Vespertilio americanus *Ord* (1815).

Bradypus pentadactylus *Kerr*, No. 140=Bradypus ursinus *Shaw* (1791)= Melursus ursinus (*Shaw*).

Myrmecophaga jubata sima *Kerr*, No. 143. Not determinable. ? *Orycteropus*, sp.

Myrmecophaga pentadactyla *Kerr*, No. 145=Myrmecophaga striata *Shaw* (1800)=Le Tamandua *Buffon*. (Anim. fict.)

Dasypus maximus *Kerr*, No. 158=Dasypus gigas *Cuvier* (1817)=Dasypus giganteus *Desm.* (1820). As all are based on Buffon, Hist. Nat., X, plate xli, hence, **Priodon maximus** (*Kerr*).

Dasypus longicaudatus Kerr, No. 160=American Armadillo *Watson*, Phil. Trans., LIV, p. 57, pl. vii, and Cachicame ou Tatou à neuf bandes *Buffon*, X, p. 215, pl. xxxvii=Dasypus peba *Desm.* (1820)=Dasypus longicaudus *Wied* (1826)=Tatusia novemcincta (*Linn.*). For those who reject *novemencincta* Linn., the species will stand as **Tatusia longicaudatus** (*Kerr*).

Sukotyrus indicus *Kerr*, 163. Mythical.

Elephas americanus *Kerr*, No. 165=Elephas americanus *Cuvier* (1798)=Mastodon giganteum *Cuvier* (1817). Hence, **Mastodon americanus** (*Kerr*).

Kerr's name was based on Pennant's "American Elephant," which is in reality a Mastodon, as shown from the following transcript from Kerr :

> "In America, on the banks of the Ohio, are found, several feet below the surface, in a marshy place called Big-bone-swamp, great numbers of tusks and grinders, supposed by many to belong to the Elephant : But the grinders are totally different, being covered uniformly with enamel, and furnished with a double row of high conic processes, like those of carnivorous animals ; whereas those of the Elephant are composed of alternate perpendicular layers of bone and enamel, and are ribbed transversely on their upper surfaces, like those of graminivorous quadrupeds : Hence the species must be entirely different ; and Mr. Pennant has chosen to suppose that they have belonged to an unknown species of this genus, which he names the American Elephant. Hist. of Quad., p. 71."

The earliest reference by Cuvier to this animal I have seen is the following : "C'est l'*elephas americanus* de Pennant."—(Tableau élémen. de l'Hist. Nat., 1798, p. 149). Here he simply gives a Latin rendering of Pennant's name. Later (Règne An., I, 1817, p. 116) he gave it the name *Mastodon giganteum*, as cited above.

Elephas americanus Kerr antedates by fifty years the name *Elephas americanus* given by DeKay in 1842 to remains of a fossil Elephant from the State of New York. In this latter sense the name is of course untenable.

Trichechus manatus siren *Kerr*, No. 170. Mythical.

Phoca grœnlandica nigra *Kerr*, No. 180=Phoca grœnlandica *Fabr.*

Phoca hispida quadrata *Kerr*, No. 182=? Halichœrus grypus (*Fabr.*).

Phoca chilensis *Kerr*, No. 186=? Macrorhinus leoninus (*Linn.*) juv.

Phoca mutica *Kerr*, No. 187=Phoca longicollis *Shaw*. Not determinable.

Phoca testudo *Kerr*, No. 189. Not determinable.

Phoca laniger *Kerr*, No. 191=? Erignathus barbatus (*Fabr.*) juv.

Phoca punctata *Kerr*, No. 192. Not determinable.

Phoca maculata *Kerr*, No. 193. Not determinable.

Phoca nigra *Kerr*, No. 194=Collotaria ursinus (*Linn.*). juv.

Canis lupus niger *Kerr*, No. 236=Black phase of Canis lupus nubilus (*Say*).

Canis lupus albus *Kerr*, No. 237=? Canis lupus mexicanus (*Linn.*).

Canis vulpes alopex americanus *Kerr*, No. 249. Not determinable.

Canis vulpes chilensis *Kerr*, No. 258. Not determinable.

Canis vulpes australis *Kerr*, No. 259=Loup-renard *Bourgainville*=Canis antarcticus *Shaw*, 1800. Hence, **Canis (Pseudalopex) australis** (*Kerr*).

Felis leopardalis *Kerr*, No. 266. Not determinable.

Felis cougar *Kerr*, No. 272=Felis concolor *Linn.*

Felis mexicana *Kerr*, No. 274. Not determinable. Not Felis mexicana *Desm.* (1820), nor of *De Saussure* (1860).

Felis bengalensis *Kerr*, No. 275=Felis bengalensis *Desm.* (1822). Hence, *Felis bengalensis* **Kerr.**

Felis catus aureus *Kerr*, No. 286. Not determinable. Not Lynx aureus *Raf.* (1817)=Felis aureus *Desm.* (1820).

Felis (Lynx) montana *Kerr*, No. 289=Lynx montanus *Raf.* (1817).

Felis (Lynx) bengalensis *Kerr*, No. 291=Felis caracal, var. *c.* (*Desm.*) (1820)=Felis caracal δ bengalensis *Fischer* (1830).

Felis (Lynx) nubiensis *Kerr*, No. 292=Felis caracal, var. *b. Desm.* (1820)=Felis caracal γ nubicus *Fischer* (1830).

Felis (Lynx) lybiensis *Kerr*, No. 293=Felis caracal, var. *a. Desm.* (1820)=Felis caracal β algiricus *Fischer* (1830).

Felis (Lynx) vulgaris maculatus *Kerr*, No. 297. Not Felis maculata *Horsf. & Vig.* (1829)=Lynx rufus var. maculatus *Aud. & Bach.* (1851), for which I here propose the name **Lynx texensis.**

Felis (Lynx) canadensis *Kerr*, No. 298=Lynx canadensis *Raf.* (1817). Hence, *Lynx canadensis* **Kerr.**

Viverra nems *Kerr*, No. 303=? Herpestes griseus *Thunb.* (1811).

Viverra gallica *Kerr*, No. 322=La Genette de France *Buffon*, Hist. Nat. Suppl., III, 1776, p. 237, pl. xlvi=Viverra nigra *Desm.* (1820)=Paradoxurus typus *F. Cuv. & Geoffr.* (1821): Hence, **Paradoxurus gallica** (*Kerr*).

Viverra prehensilis *Kerr*, No 327=Cercoleptes caudivolvulus (*Pall.*). Not *Viverra prehensilis* Blainv. (1816)=Paradoxurus hermaphroditus (Pall.) Blandford.

Viverra maculata *Kerr*, No. 331=Viverra maculata *Shaw* (1800)=Dasyurus maculatus (*Kerr*) *Thomas.*

Mustela (Lutra) paraguensis *Kerr*, No. 334=Chironectes minimus (*Zimm.*) *Ill.*

Mustela (Lutra) chilensis *Kerr*, No. 335=Lutra felina (*Mol.*) *Shaw.*

Mustela (Lutra) canadensis *Kerr*, No. 337=Mustela lutra canadensis *Schreber*, Pl. ccxxvi B. Hence, Lutra canadensis (*Schreber*) **Kerr.**

Mustela (Lutra) guianensis *Kerr*, No. 339=Chironectes minimus (*Zimm.*) *Ill.*

Mustela afra *Kerr*, No. 343=Mustela javanica *Seba.* Not determinable.

Mustela guianensis *Kerr*, No. 348=? Galictis vittata (*Schreber*).

Mustela laniger *Kerr*, No. 349. Not determinable.

Mustela zibellina americana *Kerr*, No. 352=Mustela americana *Turton.* Hence, Mustela americana (**Kerr**) *Turton.*

Mustela zibellina nigra *Kerr*, No. 353=Mustela pennanti *Erxl.*

Mustela melina *Kerr*, No. 362. Not determinable.

Ursus indicus *Kerr*, No. 376=Ursus indicus *Shaw* (1800)=Mellivora indica (**Kerr**).

Didelphis virginiana *Kerr*, No. 386=Didelphis virginiana *Shaw* (1800)=Didelphis marsupialis virginiana (**Kerr**).

Didelphis guianensis *Kerr*, No. 389=Didelphis murina *Linn.* (*apud* Thomas).

Didelphis caudivolvula *Kerr*, No. 392=Pseudochirus peregrinus (*Bodd.*) *Thomas* (*apud* Thomas).

Didelphis tridactyla *Kerr*, No. 397=Potorous tridactylus (*Kerr*) *Thomas*.

Didelphis vulpecula *Kerr*, No. 398=Trichosurus vulpecula (*Kerr*) *Thomas*.

Didelphis maculata *Kerr*, No. 399=Didelphis viverrina *Shaw* (1800)=Dasyurus viverrinus (*Shaw*) *Thomas*. Nec Viverra maculata *Kerr*, No. 331=Dasyurus maculatus (*Kerr*) *Thomas*.

Didelphis volans *Kerr*, No. 400=Petauroides volans (*Kerr*) *Thomas*.

Talpa flava *Kerr*, No. 405=Talpa flava *Zimm.* (1777)=Talpa flavescens *Erxl.*=Scalops aquaticus (*Linn.*).

Talpa fusca *Kerr*, No. 408=Talpa fusca *Zimm.* (1777)=Scalops aquaticus (*Linn.*).

Sorex arcticus *Kerr*, No. 416. Not determinable.

Sorex arcticus cinereus *Kerr*, No. 417. Not determinable.

Sorex cærulæus *Kerr*, No. 422=Sorex cærulescens *Shaw* (1800)=**Sorex (Crocidura) cæruleus** *Shaw*.

Sorex mexicanus *Kerr*, No. 423=Tucan of Fernandez. Not determinable.

Sorex albipes *Kerr*, No. 424. Not determinable.

Sorex quadricaudatus *Kerr*, No. 425=Sorex tetragonurus *Zimm.*=Sorex vulgaris *Linn.*

Sorex liricaudatus *Kerr*, No. 426=Sorex carinatus *Zimm.* Not determinable.

Sorex unicolor *Kerr*, No. 427=Sorex unicolor *Shaw* (1800)=Sorex constrictus *Zimm.* Not determinable.

Hystrix mexicana *Kerr*, No. 438=Hystrix mexicana *Shaw* (1801)=Synetheres mexicanus (*Kerr*) *Alston*.

Cavia aguti cunicularis *Kerr*, No. 446. Not determinable. In part=genus *Capromys*.

Cavia magellanica *Kerr*, No. 452=Cavia patachonica *Shaw* (1801)=Dolichotis magellanica (*Kerr*) *Thomas*.

Castor fiber solitarius *Kerr*, No. 456=Castor fiber *Linn.*

Mus pilorides fulvus *Kerr*, No. 461. Not determinable.

Mus americanus *Kerr*, No. 463. Not determinable.

Mus messorius *Kerr*, No. 471=Mus messorius *Shaw*=? Mus minutus *Pall.*

Mus agrarius americanus *Kerr*, No. 473=Mus leucopus *Raf.* (1818)=Peromyscus leucopus (*Raf.*). *Mus americanus* is pre-occupied by Kerr's No. 463.[1]

Mus minutus flavus *Kerr*, No. 475. Not determinable.

Mus moschatus *Kerr*, No. 481. Not determinable.

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[1] Kerr appears to have considered it admissible to use the same *varietal* name under *different species* of the *same genus*, repeated instances of which occur in his work.

Mus mexicanus *Kerr*, No. 483. Not determinable.

Mus virginianus *Kerr*, No. 484. An albino. Not determinable.

Mus rutilus minor *Kerr*, No. 494=? Evotomys rutilus (*Pall.*).

Mus arvalis nigricans *Kerr*, No. 500. Not determinable. Not *Mus nigricans* Raf. 1818.

Mus lemmus sibiricus *Kerr*, No. 505. Not determinable.

Mus lenæ *Kerr*, No. 507=Mus lenensis *Pall.*

Mus tschelag *Kerr*, No. 508. Not determinable.

Mus (Myotalpa) talpina nigra *Kerr*, No. 517=Ellobius talpinus (*Pall.*).

Arctomys suslica *Kerr*, No. 527=Mus suslica *Gülden.* (1770)=Mus citellus *Linn.* (1766).

Arctomys zemni *Kerr*, No. 529=? Ellobius talpinus (*Pall.*).

Arctomys hudsonia *Kerr*, No. 531=Tailless Marmot *Pennant.* Not determinable.

Sciurus albipes *Kerr*, No. 539. Not determinable. Not Sciurus albipes *Wagner* (1857).

Sciurus niger albirostro *Kerr*, No. 541=Sciurus niger *Linn.* (in part).

Sciurus virginianus *Kerr*, No. 547=Sciurus virginianus *Turton*=Sciurus niger cinereus (*Linn.*).

Sciurus badjing *Kerr*, No. 539=Sciurus plantani *Ljung* (1801). Hence, Sciurus badjing *Kerr*. (*cf.* Thomas, Ann. and Mag. Nat. Hist. (5) IV, 1879, p. 397).

Sciurus æstuans fasciatus *Kerr*, No. 563=? Sciurus æstuans (*Linn.*).

Sciurus variegatus minor *Kerr*, No. 566. Not determinable.

Sciurus scrotalis *Kerr*, No. 569. Not determinable.

Sciurus bancrofti *Kerr*, No. 570. Not determinable.

Sciurus guianensis *Kerr*, No. 571. Not determinable.

Sciurus capensis *Kerr*, No. 573=Myoxus inauris *Zimm.* (1783)=Myoxus africanus *Shaw* (1801)=Xerus capensis (*Kerr*) *Thomas.* Hence, **Xerus inauris** (*Zimm.*). *Sciurus capensis* Kerr and *Myoxus inaurus* Zimm. (III, p. 275) were both based on the Earless Dormouse of Pennant.

Sciurus (Petaurus) virginianus *Kerr*, No. 575=Sciuropterus volans (*Linn.*).

Sciurus (Petaurus) petaurista *Kerr*, No. 579=Sciurus petaurista *Pall.*, in part.

Sciurus (Petaurus) petaurista niger *Kerr*, No. 580=Sciurus petaurista *Pall.*, in part.

Sciurus (Petaurus) norfolcensis *Kerr*, No. 582=Petaurus sciurea (*Shaw*, 1794) *Thomas.* Hence, **Petaurus norfolcencis** *Kerr.* The name *norfolcencis* has been objected to as not geographically pertinent.

Dipus ægyptius *Kerr*, No. 588*a*=Mus ægyptius *Hasselq.* (1752 and 1762).

Dipus sibiricus *Kerr*, No. 588*b*,
Dipus sibiricus major *Kerr*, No. 589,
Dipus sibiricus medius *Kerr*, No. 590,
Dipus sibiricus minor *Kerr*, No. 591,
Dipus sibiricus pumilio *Kerr*, No. 592,

All based on Pennant, "Hist. Quad., No. 292."

Dipus labradorius *Kerr*, No. 596=Dipus hudsonius *Zimm.*=Zapus hudsonius (*Zimm.*) *Coues.*

Dipus circassicus *Kerr*, No. 597. Not determinable.

Moschus pygmæus leverianus *Kerr*, No. 634. Not determinable.

Moschus sinensis *Kerr*, No. 638. Not determinable.

Cervus alces fossilis *Kerr*, No. 640=Cervus giganteus *Goldf.* (1821)=Cervus hibernus *Desm.* (1822)=Cervus megaceros *Hart* (1826), etc. Hence, **Alces (Megaceros) fossilis** (*Kerr*).

Cervus tarandus grœnlandicus *Kerr*, No. 641=Cervus tarandus β grœnlandicus *Gmel.*=Rangifer tarandus grœnlandicus (**Gmel.**)—*not* Kerr.

Cervus tarandus caribou *Kerr*, No. 643=Cervus tarandus γ caribou *Gmel.*=Rangifer tarandus caribou (**Gmel.**)—*not* Kerr.

Cervus elaphus minutus *Kerr*, No. 649. Not determinable.

Cervus axis maculatus *Kerr*, No. 651=Cervus axis *Erxl.*

Cervus axis unicolor *Kerr*, No. 652=Cervus axis, β *Gmel.*=Cervus unicolor *Schreber* (1792).

Cervus axis major *Kerr*, No. 654=Great Axis *Pennant.*

Cervus porcinus maculatus *Kerr*, No. 656=Cervus porcinus *Zimm.* (1777), also of *Schreb.* (pl. ccli) and *Gmelin.*[1]

The following thirteen species of *Cervus* (Nos. 662–675) are given as "Uncertain Species." They are based on Fernandez, Barrere, Buffon and Pennant.

Cervus temama *Kerr*, No. 662=Tama-maçame *Hernandez*=Mazama tema *Raf.*[2] (1817)=Cervus rufinus *Bourc. & Puch.* Hence, **Mazama temama** (*Kerr*).

Cervus cuguapara *Kerr*, No. 663=Cuguacu-apara *Marcgrave*=Cervus campestris *F. Cuv.* (1817), at least in part.

Cervus caguete *Kerr*, No. 664=Cuguacu, etc. *Marcgr.* Not determinable.

Cervus sylvaticus *Kerr*, No. 665=Cervus mexicanus *Gmel.* (in part)=Biche des bois *Barrere*=Cervus rufus *F. Cuv.* (1817), in part.

Cervus paludosus *Kerr*, No. 666=Biche des polétuviers *Barrere.* Not determinable. Probably not *Cervus paludosus* Desm. 1821, but Desmarest's name is rendered untenable.

Cervus mazame *Kerr*, No. 667=Mazame *Buffon.* Referred by F. Cuvier to his *Cervus campestris*, and by Goldfuss to his *C. leucogaster.*

Cervus cariacou *Kerr*, No. 668=Cariacou *Buffon*=? Cervus rufus *F. Cuvier* (1817).

Cervus barallou *Kerr*, No. 669=Biche de barallou *Buffon.* Not determinable.

Cervus nemorosus *Kerr*, No. 670=Biche des bois *Buffon.* Not determinable.

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[1] Under the genus *Cervus*, Gmelin cites Schreber's plates, while Schreber's text to the same plates cites Gmelin, showing that the plates of Schreber's in question were published long in advance of the text relating to them. Kerr does not cite either, but bases his new names on Pennant and Buffon.

[2] See Merriam, Science, N. S. I, 1895, p. 19.

Cervus pratensis *Kerr*, No. 671=Biche des savanes *Buffon.* Not determinable. Sometimes referred to *Cervus campestris* F. Cuvier.

Cervus indicus *Kerr*, No. 672. Based on Pennant's description and figure of a pair of antlers supposed to have come from India.

Cervus squinaton *Kerr*, No. 673. Based on Pennant's allusion to a kind of Deer so-called in the country west of Hudson Bay.

Cervus anomalus *Kerr*, No. 675. Based on the malformed antlers of a deer, supposed to have come from America. Not determinable.

Antilope saltans *Kerr*, No. 688=Antilope euchore "*Forster*" *Schreber*, Pl. cclxxii. This plate is cited by Pennant (3d ed., I, 1793, p. 94), and is thus probably of even date with Kerr.

Ovis ammon europæa *Kerr*, No. 733=Ovis musimon "*Schreber*," auct.=Ovis musimon "*Pallas*" *Schreb.* Säuget. Pl. cclxxxviii *A*. The plate is credited (Säuget. Theil V, i, p. 1471) to "Fr. Cuv. et Geoffr. mammif, 18^e livr.," published in 1819=Ægoceros musimon *Pall.*, Zool. Rosso-Asiat., I, 1831 (1811 ?), p. 230, Pl. xix, fig. 7 (skull). This is the earliest use of the name in a specific sense by Pallas that I can find, and Wagner (Schreb. Säuget. Th. V, p. 1372 and Pl. cclxxxviii *A*) evidently thence derived it. Hence the name of the Corsican Sheep or Monflon should stand as **Ovis europæa** (*Kerr*).

Bos arneë *Kerr*, No. 746=Bos arnee *Shaw* (1801)=Bos bubalis *Linn.*= **Bubalus bubalis** (*Linn.*).

Bos barbatus *Kerr*, No. 758. Not determinable.

Sus tajassu minor *Kerr*, No. 780=Dicotyles tajusu (*Linn.*) juv.

Sus tajassu patira *Kerr*, No. 781=Dicotyles tajacu (*Linn.*) juv.

Delphinus phocæna albus *Kerr*, No. 803. Not determinable.

Delphinus phocæna fuscus *Kerr*, No. 804. Not determinable.

Article VI.—ON A COLLECTION OF MAMMALS FROM ARIZONA AND MEXICO, MADE BY MR. W. W. PRICE, WITH FIELD NOTES BY THE COLLECTOR.

By J. A. Allen.

The collection on which the present paper is based numbers about 1500 specimens, collected mainly from January to September,[1] 1894, by Mr. W. W. Price, with the assistance of Mr. B. C. Condit and others, as noted below. The collection was made chiefly in Cochise County, Arizona, but includes several outlying localities in Pima, Graham and Apache Counties, Arizona, and in northern Sonora. The whole collection was sent to the American Museum, but later one-half of it was purchased by the Field Columbian Museum of Chicago, the other half remaining here.

I am greatly indebted to Mr. Price for the field notes incorporated in the present paper, and for his account of the physical characteristics of the areas visited, including an itinerary of the trip and a descriptive list of the localities where collections were made. Also for a supplementary list of species observed but not represented in the collection. The field notes are presented in connection with the technical remarks on the species to which they relate, and are distinguished by being enclosed in marks of quotation, and by the initials "W. W. P." The more general matter furnished by Mr. Price is given under special headings, bearing his name.

In this connection it gives me pleasure to acknowledge my indebtedness to Dr. C. Hart Merriam, Chief of the Division of Ornithology and Mammalogy, United States Department of Agriculture, for the loan of material to aid in the identification of some of the more obscure species.

The collection here under notice is exceptionally important for the large series of many of the species represented, and for the large number of specimens gathered from a few limited areas.

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[1] About 25 specimens, collected in November and December, 1894, at Sentinel and Phœnix, have come to hand just as this paper goes to press, adding two species to the Price Collection.

The principal localities at which collections were made appear to have been very thoroughly worked, so far as the smaller mammals are concerned, though perhaps none of them exhaustively, owing to the small amount of time spent at each.

The following communication from Mr. Price contains important information respecting the localities visited and the general character of the region.[1]

I.—ITINERARY OF THE EXPEDITION, AND DESCRIPTION OF THE REGION EXPLORED.

By W. W. PRICE.

Itinerary.—On the 3d of January, 1894, in company with Mr. B. C. Condit and Mr. M. P. Anderson, I arrived at Tucson, Arizona, and began an extended collecting trip in southern Arizona and northern Sonora, Mexico. For eight months we were continually in the field, covering a distance on long and short trips of over 2000 miles, the greater part of the way with pack animals and through almost impassable mountains. From March to September we were assisted in our work by Mr. L. H. Miller. The mammal part of our collection consists of about 1500 specimens collected in various parts of the region.

A brief itinerary of our expedition is as follows: We began work at Fort Lowell, a deserted military post, about seven miles east of Tucson, on the Rillito Creek. We remained in the neighborhood of Fort Lowell until January 25, when we moved camp to the Huachuca Mountains, about ten miles north of the Mexican line. From this point we made various excursions through the mountains and one ten-days' trip into the Santa Cruz Mountains, Sonora, near the town of Santa Cruz. On the 20th of February we moved to Fairbank on the San Pedro River, remaining there until March 16, with the exception of four days spent at Fort Lowell, March 6–10. On the 16th of March we went by team to Camp Rucker, in the Chiricahua Mountains, about 75 miles east of Fort Lowell. From that point Mr. Condit went south to San Bernardino Ranch, on the Mexican border, about 10 miles west of the New Mexico line. I remained in the Chiricahua Mountains, when not on excursions to and from San Bernardino Ranch and the Huachuca Mountains, until July 10. Mr. Miller remained at Fort Lowell until May 18, when he moved to the Huachuca Mountains ; from there he moved to the Chiricahua Mountains, July 8. Here he stayed until September 5. May 12 Mr. Condit broke camp at San Bernardino Ranch, went into Sonora as far south as Oposura, returning to my camp in the Chiricahua Mountains the latter part of June. On July 10 Mr. Condit and I began our trip north, a distance of over 200 miles, to Holbrook, a station on the Atlantic and Pacific Railway, making various side excursions *en route* into the Graham and White Mountains. Our work ended at Holbrook, Arizona, September 1.

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[1] To prevent incongruity in nomenclature, the scientific names of genera and species in Mr. Price's contributions to the present paper have been changed, where necessary, to make them conform to those herein adopted. Otherwise his notes are published as written.

Characteristics of the Region.—Briefly, Arizona is divided by a great plateau extending across the entire Territory from northwest to southeast. Here are found the two most lofty groups of mountains in Arizona, the San Francisco Mountains in the northwest and the White Mountains in the southeast portion of the plateau. This height of land, usually called the Mogollon Mesa, slopes gradually on the north into the desert of the Little Colorado River; on the south it drops abruptly from 3000 to 5000 feet into the desert region of the Colorado and Gila Rivers. It is with this southern half of the Territory that we have most to do.

Southeastern Arizona and northeastern Sonora are made up of narrow alluvial river bottoms, plains more or less level and sandy, destitute of trees and often of brush, and irregular mountain ranges, indescribably abrupt and jagged. The Gila River with its two main branches, the Salt and San Pedro Rivers, drains southern Arizona; the Rios Yaqui and Sonora drain northeastern Sonora, flowing into the Gulf of California. The chief mountain ranges in southeastern Arizona are the Santa Catalina, Santa Rita, Rincon, Huachuca, Chiricahua and Graham Mountains; in northeastern Sonora are the Sierra Canonca, Sierra Azula, Sierra Ajos, Sierra Huasavas, and the great backbone of western Mexico, the Sierra Madre, which begins near the United States border. The general trend of these mountains is from north to south, and they are lifted from 4000 to 6000 feet above the plains at their base.

Climate.—The climate of Arizona is excessively dry, the rain falling chiefly during the months of July and August. There is also a scanty and irregular rainfall during January, February and March, but the summer rains are most to be depended upon. However, some years it is exceedingly scanty. During 1891 and 1892 a drought prevailed over Arizona and Sonora; hundreds of thousands of cattle died, and even the people in the latter country were reduced almost to starvation. In the Huachuca Mountains the streams had mostly dried up, and many pines and oaks on the hillsides died for want of water. There are no general rainstorms during the summer, but intense thunderstorms occur, usually very local in character, and centering about the mountains. Rains may water abundantly one district and grass be luxuriant, while five miles away the ground may be as dry and bare as a floor. Cloudbursts are of frequent occurrence, happening usually in the mountains. After the summer rains the whole country is transformed. On the hot, bare plains suddenly appear luxuriant grasses and beautiful plants, changing the region into a veritable garden. The winter storms are different, usually beginning after a cold south wind has blown for several days; the sky is leaden gray. These storms of sleet and rain continue for two days at a time. However, little rain falls and spring pasture upon the plains amounts to very little.

In summer, on the lower plains and deserts, the heat is intense, often reaching 110° to 115° F. in the shade. In the mountains, above 6000 feet elevation, the weather is delightful. The coldest weather recorded at 6000 feet elevation, at the base of the Huachuca Mountains during February, was 18° above zero.

Life Areas.—South of the Gila River, there appear to be *five* pretty well-defined life zones. Too much confidence, however, must not be placed in the figures, for what is true in one range may be greatly varied in another. Considering the wide extent of territory and its conformation, it is impossible to map it in any but a very general way.

1. This is the desert zone proper, reaching an elevation of about 3000 feet. The characteristic plants are cacti in great abundance and variety. *Lepus alleni* and *Spermophilus* [=*Anisonyx*] *tereticaudus* are characteristic mammals.

2. The upper desert zone, ending at about 5500 feet elevation, includes most of the grassy plains of southern Arizona. The cacti are here few in species and number. The Prairie Dog (*Cynomys*), and two small Spermophiles (*S. macrospilotus* and *S. cryptospilotus*) are characteristic of this region.

3. This zone extends from about 5500 to about 7000 feet above sea level. This is the black oak, juniper, and piñon zone. In it is found *Sitomys* [=*Peromyscus*] *rowleyi pinalis*; it is the highest limit of the Common Jack-rabbit (*Lepus texianus eremicus*).

4. The pine zone extends to nearly 9000 feet, and is characterized by the yellow pine, white oak, and maple. In the Huachuca Mountains, *Sciurus arizonensis huachuca* is found in this zone, and *S. rowleyi pinalis* finds its limit in the lower portions.

5. The fir and aspen belt reaches the summit of the mountains, above 9500 feet in elevation. This is practically the Canadian life-zone. Some Canadian plants are found here, and the Ruby-crowned Kinglet and Pine Siskin breed commonly. The characteristic mammals are White-footed Mice (*S. a.* [=*P. leucopus*] *rufinus*), and a species of *Sorex*.

List of Chief Localities from which Collections were obtained.—*Fort Lowell.*—This is a deserted military post on the Rillito Creek, about seven miles east of Tucson. It is equally distant from the base of the abrupt Santa Catalina Mountains. On the south, the great plain of Tucson, bare or covered with brushy *Larrea* or mesquite, stretches away for scores of miles; on the north rise gravelly hills which slope up to the mountains. These hills are covered with giant cacti and other desert shrubs. Along the bed of the Rillito grow cottonwood, willow, mesquite, walnut and ash trees.

Fairbank.—A town, 3800 feet elevation, on the San Pedro River, about thirty miles north of the Mexican border. The river bottom is alluvial at this point, and many gardens and fields of alfalfa flourish. Bare hills and plains stretch down to the river on each side. A few cottonwoods and willows are found along the river.

San Bernardino Ranch.—A cattle ranch on the Mexican border about ten miles west of the New Mexican line. Large springs, which are the headwaters of the Yaqui River, rise here, furnishing much water for the irrigation of alfalfa fields. The surrounding country is of a black malpais or lava formation.

Oposura.—A town of considerable importance on the Yaqui River in Sonora, about 150 miles south of the border. It is at an elevation of about 1800 feet, and closely shut in by rocky hills. Some mining is carried on, and the river-bottom is cultivated, sugar cane being one of the principal productions.

Willcox.—A small town on the Southern Pacific Railway, in the center of the Sulphur Spring Valley, at an elevation of about 4000 feet. The surface of the surrounding country is level, and in places covered with mesquite brush. There are several alkali flats near the town, destitute of any vegetable life, and covered with water during the rainy season.

Showlow.—The name of a settlement on Showlow Creek, at the edge of the pine belt, on the northern slope of the Mogollon Mesa. There are grain and corn fields along the creek, and sheep are pastured in the woods.

Holbrook.—A station on the Atlantic and Pacific Railway near the junction of the Little Colorado and Puerco Rivers. The flats along the river are intensely alkaline and sandy. A bluff of red sandstone and cemented pebbles extends along the right bank of the river, a half mile distant from the station. The elevation is about 4000 feet.

Cooley's Ranch.—The name of a ranch on the White Mountain divide, between Fort Apache and Holbrook. It is in the midst of a luxuriant forest of yellow pines, and at an elevation of about 7000 feet.

Huachuca Mountains.—A range of mountains in southern Arizona, lying west of the San Pedro River. They are about 25 miles in length, 5 to 8 miles in width, and reach an elevation of about 10,000 feet. The range is surrounded on all sides by rather level, grassy plains.

Huasavas Mountains.—A range of mountains lying about 20 miles northeast of the town of Oposura, Sonora. The surrounding country is exceedingly rough, and the summit is reached by one steep trail. Mr. Condit spent several days in these mountains, and from him I learn that the summits are well wooded with yellow pine, and that the highest peaks are probably 8500 feet above sea level.

Chiricahua Mountains.—This range is situated in the southeastern corner of Arizona, and is the most extensive range in the region. The Sulphur Spring Valley bounds the range on the west, and the San Simon Plains touch it on the east. The lower slopes are heavily wooded with juniper and oak, and the upper regions with pine, fir and aspen.

Graham Mountain.—This is one huge mountain, with lower spurs, rising nearly 11,000 feet above the sea level, and fully 6500 feet above the plains at its base. The range is about 20 miles in length and 12 or 15 across. The lower slopes are covered with oak and pine, and on the comparatively level summit are deep forests of fir and aspen. This mountain appears to be a continuation of the Chiricahua range, though geologically it is different, being formed almost entirely of granite.

White Mountains.—This was the loftiest and most extensive range of any of the mountains visited. This group is one of the two lofty projections from the great Mogollon Mesa ; the San Francisco group to the northeast is the other. The elevation is about 12,000 feet, and the highest peaks reach timberline. Immense forests of Douglas fir stretch down the ridges. In its recesses are found Rocky Mountain Jays, Grouse, and a few bands of Elk.

II.—ANNOTATED LIST OF THE MAMMALS COLLECTED.

[The external measurements given in the following list are the collector's measurements taken from the specimens before skinning, unless otherwise stated, and are of course in millimeters.]

1. **Dorcelaphus**[1] **couesi** (*Coues & Yarrow*). SONORAN DEER.

Cervus mexicanus BAIRD, Mam. N. Am. 1857, p. 653 (excluding synonyms); in part only or not at all the *Cervus mexicanus* of Gmelin and later authors, Baird excepted.

Cariacus virginianus var. COUES & YARROW, Wheeler's Geog. and Geol. Surv. West of 100th Merid. V, 1875, p. 72.

"*Cariacus virginianus* var. *Couesi* ROTHROCK MSS." *ibid.* p. 72, and, by implication, in text, p. 75.

A small Deer, evidently the same as *Cervus mexicanus* Baird, is represented by seven specimens in the Price Collection, six of which were taken in the Santa Cruz Mountains, Sonora, Feb. 12–15 (B. C. Condit), and the other in the Huachuca Mountains, Jan. 28 (Price and Condit). They agree essentially with Professor Baird's description, based on a female taken at San Luis Springs, Sonora, so far as the description goes. It may be the same also as Lichtenstein's *Cervus mexicanus*, described from specimens sent alive to Berlin, in 1825, by Herr Graf, from "Mexico," without indication of the exact locality at which they were taken. The *Cervus mexicanus* of Gmelin, however, is a vague composite species, only in part referable to Deer from Mexico, and in all probability has no relation to the little Sonoran Deer described by Baird. The specimens here under consideration are from a point probably not more than fifty miles from the type locality of Baird's *Cervus mexicanus*. As this name is clearly untenable in the present connection, the name *couesi*, proposed by Rothrock, may be employed for its designation.

Above grayish brown, rather paler than the winter coat of *virginianus*, the hairs being broadly banded with blackish brown subterminally, and tipped with whitish; darkest along the middle region of the back, paler and slightly yellowish on the sides; belly white; axillar region pale buffy; ears dusky, the hairs tipped with gray; a narrow blackish nose band, and a small spot of blackish on each side of the lower jaw near the end. Tail yellowish brown above (the hairs brownish dusky at base); below white; no black anywhere at the surface of the hairs. Distal half of legs yellowish brown in front, lighter behind.

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[1] According to Mr. Oldfield Thomas, *Dorcelaphus* Gloger (1841) "equals and antedates" *Cariacus* Lesson (1842). *Cf.* Thomas, Ann. and Mag. Nat. Hist., (6) XV, p. 103, Feb., 1895.

Antlers of the *D. virginianus* style, but much smaller, with much shorter tines. The basal point (in four full-grown bucks) varies from one to two inches in length, and the longest point varies from three to four inches.

Measurements.—The only external measurements available are: "Ear, 140 mm.; tail, 225." The skull of an old male (largest of the series) measures as follows: Total length, 246; basilar length, 227; zygomatic breadth, 115; lower jaw, length, 188; height at coronoid, 95; height at condyle, 61; distance between base of antlers, 66; distance between points of antlers, 283.

"Common in brushy tracts of country. On Feb. 12–15 a half-dozen deer were shot in the Santa Cruz Mountains in Sonora. I shot a young buck April 2 in the Chiricahua Mountains which was shedding, having lost the greater part of its winter coat."—W. W. P.

A very good account of this little deer can be found in Coues and Yarrow (l. c.), quoted from Rothrock.

2. **Lepus alleni** *Mearns.* ALLEN'S JACK RABBIT.

Lepus alleni MEARNS, Bull. Am. Mus. Nat. Hist. II, No. 4, 1890, p. 294. Rillito, Pima Co., Arizona.

Represented by 13 fully adult specimens, taken at Fort Lowell, Jan. 5–21, by Price and Condit. The collector's measurements from the fresh specimens may be summarized as follows: Total length, 626 (600–700); tail vertebræ, 70 (45–90); hind foot, 136 (130–145); ear, 160 (156–165). Two specimens, both females, measure respectively in total length 680 and 700, but no others exceed 630, and none fall below 600, five ranging between 600 and 630.

"This splendid hare is abundant about Tucson and in lower portions of the desert belt. It is found both on the gravelly hills bordering the Rillito at Fort Lowell, and on the immense mesquite and *Larrea* plains of Tucson. It is somewhat shy, and hard to secure, except with a rifle. One rarely comes upon it suddenly. I have never seen it start up with the quick rapid flight of *L.*

texianus. It has a slow, apparently awkward gait, but its leaps are long, and it gets over the ground with surprising rapidity. In color and habits it is so very different from any other American hare, the wonder is that it should have so long remained undescribed."—W. W. P.

3. **Lepus texianus eremicus** *Allen.* ARIZONA JACK RABBIT.

Lepus texianus eremicus ALLEN, Bull. Am. Mus. Nat. Hist. VI, 1894, p. 347. Separates issued Dec. 7, 1894.

Five Fort Lowell specimens and three Fairbank specimens (taken Jan. 11 to April 18), present the following measurements: Total length, 576 (565–625); tail vertebræ, 78 (72–95); hind foot, 128 (123–138); ear, 134 (128–140).

"The common Jack Rabbit is abundant over the entire region to about 7000 feet elevation. In the desert region about Tucson, this species is somewhat supplanted by *Lepus alleni.* In the White Mountain region they occasionally wander from the piñon belt up into the pines as far as Cooley's Ranch."—W. W. P.

4. **Lepus sylvaticus pinetis** *Allen.* MOUNTAIN WOOD HARE.

Lepus sylvaticus pinetis ALLEN, Bull. Am. Mus. Nat. Hist. VI, 1894, p. 348. Separates issued Dec. 7, 1894.

Represented by 2 specimens from the White Mountains, as already described (l. c.). It differs from the Cottontail of the lowlands by its darker coloration, much smaller ears, and much more heavily clothed ears and feet.

"Two specimens only were taken by Mr. Condit in White River Cañon, in the White Mountains, at about 8000 feet elevation. A few others were seen in the same locality among oak scrub."—W. W. P.

5. **Lepus sylvaticus arizonæ** *Allen.* ARIZONA SAGE HARE.—Represented by 22 specimens, taken as follows: Fairbank, 1 ♀ ad., March 5 (Price and Condit); San Bernardino Ranch, 2 ♂♂ ad., April 8 and 16, and 2 ♀♀ ad., March 24–25

(B. C. Condit); Fort Lowell, 2 ♂♂ and 3 ♀♀, Jan. 8–18, and 2 ♀♀ and 3 ♂♂, March 21–25 (Price, Condit and Miller); Chiricahua Mountains, 6 ♀♀, April, June, July and August (Price and Miller); Huachuca Mountains, 1 ♀ juv., May 21 (Price and Miller).

These specimens appear to be all referable to the large-eared Arizona 'Cottontail.' Winter specimens (January and March examples) are purer gray on the rump and more heavily lined with black than the worn summer specimens. The Fort Lowell series of 10 adults (5 taken Jan. 8 and 5 taken March 21–25) give the following measurements: Total length, 357 (340–371); tail vertebræ, 42 (35–50); hind foot, 80 (76–88); ear, 73 (69–78).

"Common over the entire region up to about 7000 feet (except in the White Mountains), and occasional in the Huachuca and Chiricahua ranges to 8500 feet elevation. About Fort Lowell it is exeeedingly common, a dozen or more often being seen during an evening's walk. Common also about the deserted stables and buildings of the post, furnishing fine sport for moonlight hunts." —W. W. P.

6. **Thomomys cervinus**, sp. nov.

FAWN-COLORED GOPHER.

Above fawn-colored,[1] clearer on the sides, more or less obscured by dusky over the middle of the back; below gray, the fur plumbeous at base with long whitish tips. Ears black, enclosed in a blackish area; sides of the nose and muzzle blackish; inside of cheek pouches entirely pure white; feet dull whitish; tail thinly haired, pale grayish fawn color above, slightly lighter below.

Measurements.—Type (Price Collection), total length, 228; tail vertebræ, 63; hind foot, 28. Two other specimens measure as follows: Length, 228 and 263; tail vertebræ, 63 and 79; hind foot, 28 and 32.

Type, No. $\frac{10277}{8590}$, Am. Mus. Nat. Hist., ♂ ad., Phœnix, Arizona, Oct. 20, 1894; J. Diefenbach.

The species is represented by three specimens, collected for Mr. Price by J. Diefenbach at Phœnix, Arizona, Oct. 30, 1894, and were not received for examination till May, 1895. They were not marked for sex by the collector, but are apparently all males.

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[1] Ridgway, Nomen. Colors, pl. iii, fig. 22.

Thomomys cervinus is very different in coloration from any phase of *T. fulvus* I have ever met with. It is a large, pale form, about the size of *T. fossor* and *T. aureus*, but very different in color from either. In fact, in coloration, it bears a very close resemblance to *Geomys lutescens* from Phillips Co., Kansas, but the pelage is longer, coarser, and less glossy. In cranial characters it is allied to *T. aureus.* The rostral portion of the skull is especially broad and heavy, and the whole skull massive in comparison with *T. fulvus* (compare Figures 1 and 2).

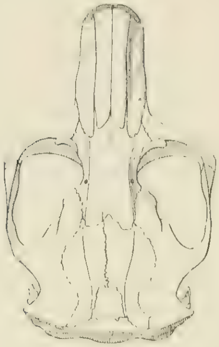
Fig. 1

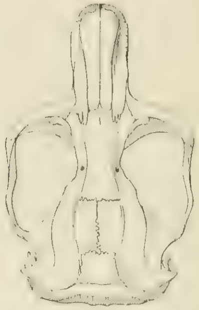
Fig. 2.

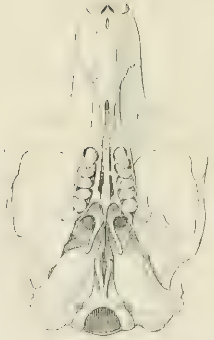
Fig. 1*a*.

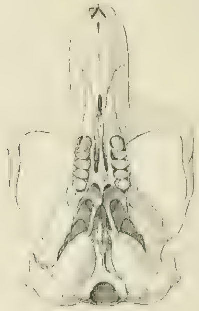
Fig. 2*a*.

Fig. 1. *Thomomys cervinus.* Type, No. $\frac{10277}{8590}$, ♂ ad., Phœnix, Arizona. Natural size.

Fig. 2. *Thomomys fulvus.* No. $\frac{8411}{6768}$, ♂ ad., San Bernardino Ranch, Cochise Co., Arizona. Natural size.

7. Thomomys fulvus (*Woodh.*). ARIZONA GOPHER.—The series of *Thomomys* numbers 112 specimens, all but three of which (as noted above) seem to be referable to *T. fulvus.* The localities represented are as follows: Fairbank, Feb. 22 to March 14, 29 specimens; San Bernardino Ranch, March 27 to April 22, 33 specimens; Fort Lowell, March 8–17, 7 specimens; Huasava Mountains, Sonora, June 25, 26, 3 specimens; Huachuca Mountains, Feb. 20, 1 specimen; Chiricahua Mountains, March 14 to April 23, and June 4 to July 20, 24 specimens; Graham Mountain, July 19, 3 specimens; White Mountains, July 28 to August 5, 8 specimens. They vary in age from half-grown young to very old adults; representing, as they do, a period of over six months, the variation in color and character of pelage is also very great. Many of them are in molt, and thus often represent two phases of pelage in the same individual. Aside, however, from differences plainly due to either age or season, there is a wide range of purely individual variation in both coloration and cranial characters. It thus becomes necessary to consider somewhat in detail several of the larger series, as those from Fairbank, San Bernardino Ranch, Fort Lowell, and the Chiricahua Mountains, in connection with much material from other localities, numbering altogether nearly 200 specimens that seem referable to what is here called *Thomomys fulvus*, including several specimens from San Francisco Mountain, the type locality of the species.

EXTERNAL CHARACTERS.—(1) *Fairbank Series.*—Three rather young specimens, for the most part in their first pelage, are dusky brown, slightly tinged with fulvous gray, darker (in one specimen black) along the middle of the back, more or less fulvous on the cheeks and sides of the shoulders, and blackish below, the hairs slightly tipped with ashy fulvous, or extensively tipped with yellowish. Other more or less immature specimens are dusky yellowish brown, more strongly dull yellowish brown on the sides, and whitish below, from the long whitish tipping of the hairs. Others are similar above to the last, but are strong rusty or fulvous gray below. From this pelage the animal molts into that of the adult, as shown by several specimens in changing pelage.

The adults are strongly yellowish brown, sometimes more or less rufescent, the intensity of the tint varying in different individuals, with generally a slight admixture of blackish tipped hairs along the middle of the back, increasing in some specimens so as to form a more or less broad median dorsal band. Two specimens, both old males, of the Fairbank series, are everywhere intense glossy plumbeous black, except the feet (and in one specimen the apical fourth of the tail), which are whitish, and the inside of the cheek-pouches, which are pure white. These specimens are doubtless simply melanistic, and are the only melanistic examples I have met with in a series of hundreds of specimens of the genus *Thomomys.*

(2) *San Bernardino Ranch Series.*—This, as regards the ages represented and the amount and character of the color variations, is almost an exact duplicate of the Fairbank series just described. The adults, however, average slightly more rufescent, several of them being strongly ferrugineous.

(3) *Fort Lowell Series.*—These are also in general very much like the Fairbank specimens. The adults, however, average a little paler, as though somewhat bleached or faded, a difference probably attributable to the fact that they were taken somewhat later in the season.

(4) *Chiricahua Mountains Series.*—These differ quite strongly from the others in being darker, through a much stronger admixture of blackish tipped hairs, and the shorter and darker shade of the fulvous apical portion of the pelage. Several of the middle-aged specimens are quite dusky brown with a slight tipping of dark yellowish brown. The young of this series, which includes a specimen not more than one-fourth grown, are not appreciably different from the young examples in the other series, as both the lightest and the darkest half-grown young are found in the present series.

The specimens from the Graham and White Mountains correspond very closely in every respect with those from the Chiricahua Mountains.

For comparison with these, good series are available from Fort Verde and Bradshaw, Arizona, from Santa Ysabel and Dulzura, San Diego Co., Cal., and from San Pedro Martir, Lower California. Specimens from any of the series can be almost exactly matched by specimens from each of the other series, except perhaps the San Bernardino Ranch series, which differs as a whole from any of the others in being less grizzled and redder. In general effect there is scarcely any appreciable difference between the Bradshaw, Santa Ysabel, and San Pedro Martir series, and between these again and those from the mountains of southeastern Arizona, including also those from the Graham and White Mountains to the northward.

Measurements.—Of this series of 109 specimens only 75 can be considered as sufficiently adult to be made the basis of comparative measurements. Females greatly preponderate in all of the series, so that out of the 75 specimens, of which measurements are given below, only 25 are males. The males average larger than the females, but old females often equal or exceed in size the smaller males.

MEASUREMENTS (AVERAGES AND EXTREMES) OF 75 SPECIMENS OF *Thomomys fulvus.*

Locality.	Sex and No. of Specim.	Total length.	Tail vertebræ.	Hind foot.	Ear.
Fairbank.......	9 ♂	235 (217–264)	71 (62–90)	32 (29–33.5)	7.2 (7 –8)
"	15 ♀	219 (195–245)	61 (49–71)	29 (28–31.5)	7 (6.5–7)
S. B. Ranch .	5 ♂	226 (205–239)	67 (58–74)	27.2 (25–29)	7 (6.5–8)
"	15 ♀	203 (193–221)	58 (56–62)	27 (26–28)	7 (6.5–8)
Fort Lowell	2 ♂	223 (220–227)	63 (62–64).	27.5 (27–28)	7.5 (7 –8)
"	3 ♀	212 (210–214)	62 (60–65)	28 (25–30)	6 (6 –6.5)
Chiricahua Mts	7 ♂	211 (201–218)	62 (50–68)	28 (27–30)	6.7 (6 –7.5)
" .	11 ♀	198 (171–225)	58 (50–68)	28 (25–31.5)	6.6 (5.5–7.5)
White Mts	1 ♂	202 (	58	28	7
"	6 ♀	194 (183–213)	59.3 (52–64)	28 (26–30)	6 (6 –6.5)

The Fairbank and San Bernardino Ranch series average larger than either of the other series. An examination of the skulls shows that these two series contain a larger proportion of very old specimens than the others, which latter happen to consist almost wholly of young and middle-aged adults.

CRANIAL CHARACTERS.—A comparison of the skulls of these several series reveals no appreciable differences by which one set can be distinguished from the others. There is a wide variation in size, besides that evidently due to age, and striking differences in certain structural details. The remarks which follow will be based wholly on the San Bernardino series, and mainly on the females of that series.

Variation due to Age.—The youngest specimen is a third-grown female. The skull is very short in proportion to its width, the shortness being due mainly to the comparative non-development, at this age, of the rostral and interorbital portions. The interorbital breadth is relatively very great, often actually greater than in the fully adult, and the zygomatic arches are relatively narrow. The interparietal is also relatively very large. This is well shown by the following comparative measurements and figures (Figs. 3–5):

No.	Total length.	Pre-parietal length.	Rostral length.	Mastoid breadth.	Zygomatic breadth.	Inter-orbital breadth.	Interparietal.	
							Width.	Length.
6803 ♀ juv. .	29	17.5	8	16	19	6.5	6	3
6799 ♀ juv...	30	18.5	8.3	16	18	6	5	3
6794 ♀ juv...	33	21	11	18	21.5	6	3.5	2
6797 ♀ ad...	37	24	12	18.5	24.5	6	3	3
6767 ♂ ad...	38.5	23.5	12	21	25	6	2.5	3.5
6753 ♂ ad...	42	26.5	14	21	26	6	4.5	3.3

The skulls given above as 'adults' are only middle-aged, there being no very old skulls in the series. The last one given is a somewhat older male from Fairbank.

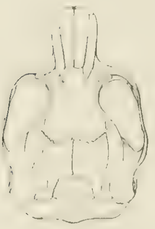

Fig .

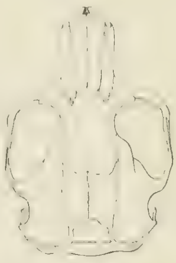

Fig. 4.

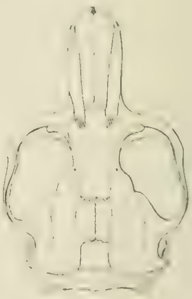

Fig. ..

Figs. 3–5. *Thomomys fulvus.* Natural size.

Fig. 3. No. $\frac{8477}{6803}$, ♀ juv., San Bernardino Ranch, Arizona.
Fig. 4. No. $\frac{8475}{6801}$, ♀ ad., San Bernardino Ranch, Arizona.
Fig. 5. No. $\frac{8471}{6797}$, ♀ old ad., San Bernardino Ranch, Arizona.

In old individuals the zygomatic arches are sharply angular both anteriorly and posteriorly, with the sides straight and parallel to the axis of the skull. In younger skulls they may be more or less convex, but are generally slightly more expanded posteriorly than anteriorly. In the young the interparietal is much larger than in the very old adults, its lateral borders becoming, with increased age, more or less overgrown by the encroachment of the parietals, as has already been noted in the case of *Neotoma micropus* (see this Bulletin, VI, 1894, pp. 233–246, Pl. iv). In young and middle-aged individuals the interparietal is usually quadrate and nearly twice as broad as long. In very old examples it becomes more or less wedge-shaped, and longer than broad. In extreme old age sometimes little or no trace of it remains, it having become wholly buried. This, however, is much more frequently the case in *T. bottæ* than in *T. fulvus*. In several old examples from Fairbank it has the form of an obtuse wedge, which is apt to be more or less truncate in front, widening gradually backward to very near the posterior border, where it widens rapidly so as to form on each side a narrow, pointed, latero-posterior angle.

From middle age on, a slight temporal ridge is developed, which in old age becomes strongly marked on each side of the interparietal area. In none of the specimens, however, is there a single median sagittal crest. The superior border of the temporal muscle is outlined on the skull quite early in life by a slight, raised line, which later on becomes pushed nearer the median line by the continued deposition of osseus matter, till in old age the two lines are only from 1 to 2 mm. apart. They are generally parallel, and extend from the front of the brain-case to the occipital crest ; later they become continuous with the slightly raised edges of the interorbital area. As these ridges thicken and move toward the median line they encroach posteriorly upon the interparietal, the lateral edges of which become buried beneath them, thus greatly altering the shape of its visible portion. As already intimated, this process is frequently carried so far in *T. bottæ* as to give rise to a well-defined sagittal crest, thus entirely concealing the interparietal.

Sexual Variation.—The skulls of males are generally larger than those of females of corresponding age, and more heavily ossified, but in other respects there seems to be no very appreciable difference.

Individual Variation.—In skulls of the same sex, and apparently of the same age, there is quite a range of variation in size, so that large females may exceed the dimensions of small males. Thus in old males from Fairbank the length of the skull varies from 38 to 42 mm., and the zygomatic breadth from 24 to 26 mm.; in old females from the same series the length varies from 36 to 39 mm., and the breadth from 22 to 24 mm.

The width of the nasal bones, and correlatively the width of the rostrum, varies considerably in individuals of the same sex and age. But the most variable feature is the size and form of the interparietal, which may be twice or three times as large in some specimens as in others. While usually quadrate, and nearly as long as wide, it may be more or less convex on the posterior border, or, in rare cases, regularly convex anteriorly from the nearly straight posterior border. As these variations (see Figs. 3–8) occur in each of the large series at hand, and in about the same proportion, they cannot be considered as other than individual. In probably 75 per cent. the interparietal is distinctly four sided, with nearly straight outlines, except for a tendency

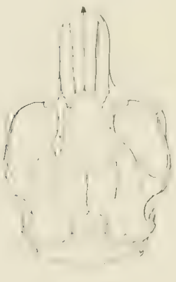

Fig. 6.

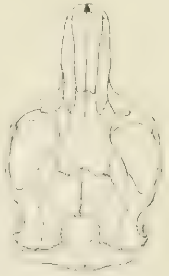

Fig. 7.

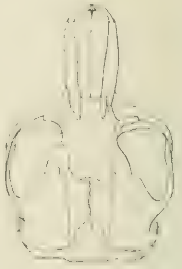

Fig. 8.

Figs. 6–8. *Thomomys fulvus.* Natural size.

Fig. 6. No. $\frac{8168}{6791}$, ♀ ad., San Bernardino Ranch, Arizona.
Fig. 7. No. $\frac{8438}{6766}$, ♀ ad . San Bernardino Ranch, Arizona
Fig. 8. No. $\frac{8170}{6796}$, ♀ ad., San Bernardino Ranch, Arizona.

to slight irregularity on the front border. The variation from this is toward a convex outline in front, the convexity varying from a slight rounding of the antero-lateral corners to one involving the whole of the lateral edges, resulting in a uniform convex outline extending to the posterior border, as in *T. toltecus*. In case, under these circumstances, the interparietal is also small and narrow, it closely resembles the same bone in *T. bottæ*.

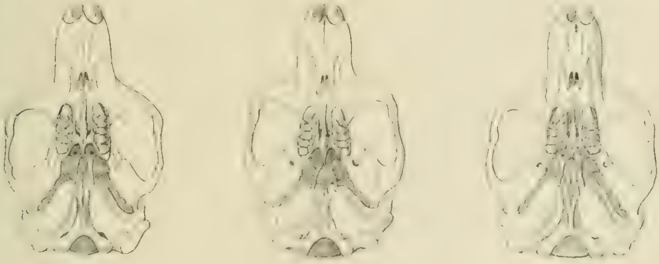

Fig. 9. Fig. 10. Fig. 11.

Figs. 9–11. *Thomomys fulvus*. Natural size.

Fig. 9. No. $\frac{8475}{6861}$, ♀ ad., San Bernardino Ranch, Arizona.
Fig. 10. No. $\frac{8468}{6794}$, ♀ ad., San Bernardino Ranch, Arizona.
Fig. 11. No. $\frac{8470}{6796}$, ♀ ad., San Bernardino Ranch, Arizona.

The lower surface of the skull also presents much variation in details in specimens from the same locality strictly comparable as to age and sex. A single feature—the pterygoid hamuli—is here selected for illustration. As shown in Figs. 9–11, these vary in respect to the angle of divergence of the processes and in their conformation.

In consequence of these variations it is almost impossible to point out any single cranial character that may be relied upon as absolutely diagnostic. The rostral and interorbital portions of the skull are broader than in *T. bottæ*, and the general form of the skull is quite different in the two species. On the other hand, the rostral portion is less developed than in the *T. aureus* group.

"This gopher was the most generally distributed of any of the mammals taken during the expedition. It was found almost everywhere from Fort Lowell to the summits of the Huachuca, Chiricahua, Graham and White Mountains. It apparently does not hibernate at all. I have known it to throw up earth under several inches of snow. It was especially abundant on the summit of Chiricahua Mountains during June and July. At a particular glade covered with grass and iris, often a half-dozen might be seen at once at nightfall raising their curious mounds of damp earth."—W. W. P.

8. **Dipodomys deserti** *Stephens.* DESERT KANGAROO RAT.—Two specimens from Sentinel, Maricopa Co. (J. Diefenbach, Dec. 20) are referable to this species. Another specimen from Phœnix (J. Diefenbach, Nov. 20) is intermediate in coloration between *D. deserti* and *D. spectabilis*, but in cranial characters is similar to the specimens from Sentinel.

These localities carry the range of *D. deserti* much to the eastward of former records. The Phœnix specimen differs so much in coloration from the others, and also from true *D. deserti*, as to suggest that it may represent a strongly-marked local form of the *deserti* group.

9. **Dipodomys spectabilis** *Merriam.* BANNER-TAILED KANGAROO RAT.—Represented by 20 specimens from Fairbank, Feb. 26-March 14 (Price and Condit); and 5 from San Bernardino Ranch, March 28-April 1 (B. C. Condit). All except 3 are fully adult. Of these latter one is nearly fully grown, and two are about one-third grown. They are very similar in coloration to the adults, but the tail, though white at the tip, is not bushy.

The adults are very uniform in coloration, allowing for the wearing off of the tips of the fur in a few of the specimens. The white at the tip of the tail, however, varies in extent in different specimens from about 45 to 85 mm.

The females average slightly smaller than the males, as shown by the following measurements of 14 males and 8 females.

Males: Total length, 344 (330-363); tail vertebræ, 198 (188-208); hind foot, 53 (49-56); ear, 17 (15-19).

Females: Total length, 322 (302-345); tail vertebræ, 185 (168-205); hind foot, 51 (48-57); ear, 16.5 (15-17).

"These beautiful Kangaroo Rats are pretty well distributed in colonies over the entire southern part of Arizona. They have hillocked towns not unlike those of *Cynomys*, and well-beaten trails from one hillock to another. The entrances, however, are horizontal, and usually enter the mound just above the level of the surrounding ground. This is no doubt a wise provision against rain, which often falls in terrific showers, and would otherwise flood the nest. One moonlight night at Willcox I had an opportunity of watching their habits. Secreting myself by a large hillock from which several trails radiated, I had not long to wait before I heard a slight noise on the gravel. It was a Rat approaching from another hillock, perhaps thirty yards away. It made low leaps of from one to several feet, and, as nearly as I could distinguish, ran, or alighted only on its hind feet. Several were sometimes leaping about the hillock at the same time. Some had ventured a dozen feet or more away, as if searching for seeds. During all the time I heard no sound of any kind, except a low chuckle uttered at intervals. They are difficult to secure with baited traps, but are readily caught in steel traps placed in the runways or entrances to their homes. They breed early, for half-grown young were caught March 1."—W. W. P.

10. **Dipodomys merriami** *Mearns.* MERRIAM'S KANGAROO RAT.—This species is represented by 156 specimens, collected as follows: Fairbank, Feb. 22–March 12, Price and Condit, 93 specimens; San Bernardino Ranch, March 22–May 1, B. C. Condit, 33 specimens; Fort Lowell, Jan. 19 and March 8–April 20, L. Miller, 25 specimens; Phœnix, November 5–Dec. 12, J. Diefenbach, 5 specimens.

The Fairbank and San Bernardino Ranch series are practically indistinguishable in respect to both size and coloration, but the Fort Lowell series averages appreciably smaller and more yellow. As usual with the Kangaroo Rats, the females average considerably smaller than the males. For comparison the measurements of the several series are given separately, as follows:

MEASUREMENTS (AVERAGES AND EXTREMES) OF 112 SPECIMENS OF *Dipodomys merriami.*

Locality.	No. of specimens.	Total length.	Tail vertebræ.	Hind foot.	Ear.
			MALES.		
Fairbank..........	41	246 (232–264[1])	139 (120–152)	39.4 (36–42)	13.7 (13–15)
S. B. Ranch......	12	248 (232–261)	142.6 (129–154)	38.4 (37–40)	14 (13–15)
Ft. Lowell........	12	233.5 (222–255)	136.5 (132–155)	36.6 (35–38)	14 (12–15)
			FEMALES.		
Fairbank..........	30	238 (223–264)	137 (124–150)	38.2 (36–40.5)	13.5 (12.5–15)
S. B. Ranch......	11	236 (222–248)	140 (124–146)	38 (35–40)	13.5 (13–14.5)
Ft. Lowell........	6	227 (215–246)	131.6 (126–147)	36.6 (36–38)	13.7 (12.5–15)

[1] For one specimen the total length is given as 271.

Young specimens, one-fourth to two-thirds grown, do not differ appreciably in coloration from adults.

"This is the most abundant Kangaroo Rat in southern Arizona where it bears the same relation to the kangaroo rats as *Perognathus obscurus* does to the pocket mice. It apparently does not hibernate at all, as specimens were caught on the coldest and most stormy nights. Its burrows, placed anywhere in sandy soil, are often closed during the daytime."—W. W. P.

11. Perodipus chapmani (*Mearns*). CHAPMAN'S KANGAROO RAT.—Of this species Messrs. Price and Condit collected 17 specimens at Fairbank, Cochise County, Feb. 22–28, the only locality at which they seem to have met with it. It was taken with *Dipodomys merriami*, 32 specimens of which were collected at Fairbank between the same dates, and many others at the same locality later, as well as at other points in Cochise County. The two species greatly resemble each other in size and coloration, and are readily distinguished externally only by the presence of the rudimentary fifth toe on the hind foot of *P. chapmani.*

Of these 17 specimens 14 are males and 3 females; all are practically adult except two, which are but little more than half-grown. The 11 fully adult males measure as follows: Total length, 232 (223–247); tail vertebræ, 127 (120–136); hind foot, 38 (36–40); ear, 14 (13–15). Three fully adult females measure:

Total length, 231 (227–237); tail vertebræ, 123 (119–130); hind foot, 38.5 (38-39); ear, 14 (13.5–15).

I also refer to this species two specimens from Fronteras, Sonora, taken May 15, by Mr. B. C. Condit. One is a nearly adult female, the other a nursling, apparently not more than a few days old. The young specimen is very dark—almost black, with a very faint fulvous tipping to the hairs on the flanks and across the shoulders. All the white markings shown in the adult are, however, present, and being pure white are very sharply defined against the blackish ground color.

"This species was not uncommon at Fairbank, where it was found associated with *Dipodomys merriami* in the proportion of about one to three of the latter. They apparently live together, as specimens of each were caught from the same hole.

"Mr. Condit shot at Fronteras, Sonora, May 15, a female carrying a young in its mouth during the daytime. This was the only specimen taken, besides those at Fairbank. So far as we could determine, its habits are identical with those of *Dipodomys merriami*."—W. W. P.

12. **Perognathus flavus** *Baird.* YELLOW POCKET-MOUSE.—Of the 10 specimens representing this species, 4 were collected at Fairbank (Feb. 28–March 2, Price and Condit), and 4 at Fort Lowell (April 5 to May 9, L. H. Miller). Three very young specimens (about half grown) from the Chiricahua Mountains (July 4–21) are also referred here.

"Quite common in fine sandy soil among bunches of sacaton grass at Fairbank. Its burrows, no larger than a little finger, usually ran horizontally into a small mound, and were often closed during the day with fine sand. It readily ate rolled oats, but was rather difficult to catch in our cyclone traps, owing to its small size and light weight. Mr. Miller found it not uncommon in the sandy fields about Fort Lowell. A single specimen was caught alive in a field at the western base of the Chiricahua Mountains, on July 4. It was said to be quite common, being often turned up in plowing."—W. W. P.

13. Perognathus bimaculatus[1] *Merriam.* ARIZONA POCKET-MOUSE.—This species is represented by 11 specimens, all from Holbrook, collected August 25–29, by Price and Diefenbach. Three are quite young, one being little more than half grown. In this specimen the general color above is pale yellowish drab, with a pale yellow lateral line, and a broad yellowish band on each side of the head, extending from the nose to the ear, the eye being at about the centre of this area.

"Found only at Holbrook, where the species was not uncommon on the sand flats along the Little Colorado River."—W. W. P.

14. Perognathus apache *Merriam.* APACHE POCKET-MOUSE.—Represented by an adult female taken at Fort Lowell, April 8, by Mr. L. H. Miller, and by two specimens from Holbrook, taken August 26 and 27, by Price and Diefenbach. One is an adult female ; the other consists of the head and front half of the body and the skull, of unknown sex.

"Two specimens were taken on sandy flats at Holbrook on August 26 and 27. They were found in company with *Perognathus bimaculatus.* A single specimen was caught by Mr. Miller in sandy soil at Fort Lowell, on April 8. These three are the only specimens obtained."—W. W. P.

15. Perognathus obscurus *Merriam.* BROWN POCKET-MOUSE.

Perognathus obscurus MERRIAM, N. Am. Fauna, No. 1, p. 20, pl. iii, fig. 14 and pl. iv. Oct. 1889. Camp Apache, Grant Co., N. Mex.

Perognathus pricei ALLEN, Bull. Am. Mus. Nat. Hist. VI, 1894, p. 318 (young). Oposura, Sonora.

This species is represented by 168 specimens, collected at the following localities :

Fairbank, Feb. 22 to March 15, Price and Condit, 57 specimens, of which 41 are males and 16 females. All are adult, as regards coloration, but about one-fourth are not quite fully grown, as shown by the measurements and the character of the skulls.

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[1] A large part of the specimens from Riverview, Utah, referred in a former paper (this Bulletin, V, p. 71) to *P. apache* prove on examination to be *P. bimaculatus*, both species being represented in the series.

Fort Lowell, March 8 to May 10, L. H. Miller, 46 specimens, of which 29 are males and 17 females. Very nearly all are fully adult.

San Bernardino Ranch, March 22 to May 4, B. C. Condit, 38 specimens, of which 32 are males and 6 females. All are adult as regards coloration, and with few exceptions also as regards size.

Oposura, Sonora, May 30 to June 2, B. C. Condit, 16 specimens, of which 12 are males and 4 females; 11 are adult and 5 are young.

Willcox, July 15, Price and Condit, 9 specimens, of which 3 are nursing females and 5 are young males; some of the latter are less than half grown, and all are in first pelage except one, which has begun to acquire the adult dress.

Sentinel, Dec. 20, J. Diefenbach, 2, adult.

From the foregoing it would seem that the young are born late in the season, apparently not till May or June, as the only very young examples, and the only females giving evidence of nursing young were the Oposura specimens taken the last of May, and the Willcox specimens taken July 15. It is also noteworthy that the number of males at all of the localities largely exceeds that of the females.

The type locality of *Perognathus obscurus* is the southwestern corner of Grant County, New Mexico, but a few miles from San Bernardino Ranch, in the southeastern corner of Cochise County, Arizona. I am indebted to Dr. C. Hart Merriam for the loan of three 'topotypes' of *P. obscurus*, taken in April and May, 1886, for comparison with the Arizona series. They are slightly more fulvous than the average of the specimens from either of the localities mentioned above, but can be closely matched by examples from either series, while the Fort Lowell specimens are practically indistinguishable as a series from the Grant County specimens.

The young in first pelage are nearly uniform dark gray above, with a slight tinge of brownish, sparsely lined with blackish hairs; below white, as in the adult. There is barely a trace of a very pale yellowish lateral line. Young adults are grayer and less fulvous than the fully mature individuals.

The specimens from Oposura are all flat skins, so that the coloration is more condensed and the pelage apparently thicker than would be the case were the skins filled to life size. The young specimens from Oposura thus look very different from the young specimens from Willcox. On careful reëxamination of all the material it is evident that the young examples from Oposura, taken as the basis of my *Perognathus pricei* (l. c.) are not separable from *P. obscurus.*

From the following summary of the measurements taken by the collectors from the fresh specimens, it will be seen that the Fort Lowell and Oposura (adult) specimens average slightly larger than those from the other localities; they are also more strongly fulvous.

SUMMARY OF MEASUREMENTS (AVERAGES AND EXTREMES) OF 130 ADULT SPECIMENS OF *Perognathus obscurus.*

Locality.	Sex and No. of Specimens	Total length.	Tail vertebræ.	Hind foot.	Ear.
Fairbank....	32 ♂	180 (165–196)	87 (80–105)	23 (22 –24)	9 (8–10)
" ...	14 ♀	170 (160–178)	86 (82– 94)	23 (22 –24)	8.6 (8– 9)
Fort Lowell..	27 ♂	182 (170–200)	93 (88–110)	23 (21.5–24.5)	8.7 (8– 9.5)
" ..	14 ♀	173 (160–192)	86 (82–103)	22.6 (21 –24)	8 3 (8– 9)
S. B. Ranch.	28 ♂	177 (166–190)	92 (81–107)	23 (22 –24.5)	9 (8– 9.5)
" .	5 ♀	173 (164–183)	91 (89– 96)	23 (22 –25)	8.7 (8–10)
Oposura.....	7 ♂	188 (177–197)	98 (78–105)	23 (22 –24 5)	9 (8–10)
"	3 ♀	177 (165–190)	94 (88–100)	22.5 (21 –23)	9 (9– 9.5)

Of the whole series of 130 specimens, 12 males and 4 females reach or exceed 190 mm. in total length; and 16 males and 4 females reach or exceed 100 mm. in the length of tail vertebræ. Fourteen males and 16 females fall below a total length of 170 mm.; and 5 males and 6 females fall below 85 mm. in length of tail vertebræ.

"This is the common Pocket-mouse of the region south of the Mogollon Mesa, where it outnumbers all the others, three to one. We found it especially abundant at Fort Lowell, Fairbank, Willcox, San Bernardino Ranch, and at several points in Sonora. It was abundant at Fairbank as early as February 22, but as none were obtained at Fort Lowell in January, it is not unlikely that it hibernates during the colder months. The holes sometimes descend perpendicularly into the ground, but usually enter horizontally into mounds heaped under mesquite bushes by wind; during the hot weather it often closes the entrance with fine sand. These animals were caught readily with rolled oats. I often found seeds of various plants and mesquite beans in their pockets."—W. W. P.

16. **Perognathus conditi** *Allen*. CONDIT'S POCKET-MOUSE.

Perognathus conditi ALLEN, Bull. Am. Mus. Nat. Hist. VI, 1894, p. 318. (Separates published Nov. 7, 1894.)

This species, as already noted (l. c.), was based on 3 specimens, taken at San Bernardino Ranch, March 23, 1894, by Mr. Condit.

"On March 23 and 24 Mr. Condit caught two adult specimens of this brightly-colored Pocket-mouse in a boggy patch of ground thickly grown with sacaton grass. Later, on May 1, he obtained a third specimen in sandy soil among mesquite trees."—W. W. P.

17. **Microtus leucophæus** (*Allen*). WHITE-BELLIED MEADOW MOUSE.

Arvicola leucophæus ALLEN, Bull. Am. Mus. Nat. Hist. VI, 1894, p. 320. (Separates published Nov. 7, 1894.)

The four specimens of a very white-bellied *Microtus* from Graham Mountain have already been recorded (l. c), and do not require further comment.

"Four specimens were taken near the summit of Graham Mountain, at an elevation of about 10,000 feet, on July 18, 19. They were all found along boggy streams shaded with dwarf alders. There were no traces of runways in any of the surrounding meadows."—W. W. P.

18. **Microtus alticolus** (*Merriam*). MOUNTAIN MEADOW MOUSE.

Arvicola (*Mynomes*) *alticolus* MERRIAM, N. Am. Fauna, No. 3, 1890, p. 67, pl. v, figs. 1 and 2, and pl. vi, figs. 1–4. San Francisco Mountain, Ariz.

Two specimens of a *Microtus* from the White Mountains (Aug. 3 and 8, B. C. Condit), an adult female and a young male, are provisionally referred to this species. The adult female measures: Total length, 168; tail vertebræ, 50; hind foot, 21; ear, 17.

"These specimens were obtained in the White Mountains at an elevation of about 9000 feet. They were trapped among fallen logs along creeks where no runways were apparent. On a grassy meadow near the summit of the mountains, the well-beaten runways of an *Arvicola* were abundant. Several hundred must have comprised the colony. Though a dozen traps were set for them, not one specimen was taken."—W. W. P.

19. **Sigmodon minimus** *Mearns.* MEARNS'S COTTON RAT.

Sigmodon minima MEARNS, Proc. U. S. Nat. Mus. XVII, 1894, p. 130. Upper Corner Monument, New Mexico.

Represented by two old males, taken at San Bernardino Ranch, April 11 and May 9 (B. C. Condit), less than fifty miles west of the type locality of the species. These specimens measure: Total length, 246 and 241; tail vertebræ, 95 and 99; hind foot, 28 and 25; ear, 19 and 18. They are slightly larger than the two specimens on which Dr. Mearns (l. c.) based the species, his examples, also "adult males," measuring respectively as follows: Total length, 223 and 223; tail vertebræ, 94 and 91; hind foot, 28 and 27; ear, "above crown," 14 and 12; "above notch," — and 16.

"Two specimens of this species were taken by Mr. Condit at San Bernardino Ranch. They were found in a boggy patch of ground, a half-acre or so in extent, thickly grown with coarse sacaton grass. Careful search failed to show traces of any others. Curiously enough, this species, which has just been described by Dr. E. A. Mearns from southern New Mexico, was found associated so closely with the new pocket mouse *P. conditi* that specimens of both were caught in the same spot."—W. W. P.

20. Sigmodon hispidus arizonæ *Mearns.* ARIZONA COTTON RAT.—The only locality represented is Fairbank, where a series of 12 specimens was taken by Price and Condit, Feb. 25 to March 15. Five are adult males and 7 are females, one of which is quite young, and several others appear not to have quite reached mature growth, as shown by the subjoined measurements:

No. of specimens.	Sex.	Total length.	Tail vertebræ.	Hind foot.	Ear.
5	♂	250 (238–300)	111 (98–120)	34.6 (33.5–36)	20 (19–21)
5	♀	249 (232–277)	99 (90–104)	33.6 (31.5–37)	20 (19–21)

"We found this species common in swampy localities along the San Pedro River at Fairbank. Nearly a dozen were trapped in a small patch of tules, where they had beaten runways in all directions. Associated with them were *Peromyscus arizonæ* and *Reithrodontomys arizonensis*. A Cotton Rat, probably of this species, is found at Igo's Ranch, at the north end of the Huachuca Mountains. It was said to be common in a moist garden plot. However, I had no opportunity of visiting the place."—W. W. P.

21. Neotoma mexicana *Baird.* MEXICAN WOOD RAT.—Represented by 58 specimens, taken as follows: Fairbank, Feb. 25–March 3 (Price and Condit), 5 specimens; San Bernardino Ranch, March 25–27 (B. C. Condit), 4 specimens; Fort Lowell, March 7 (L. H. Miller), 2 specimens; Oposura, Sonora, May 30 (B. C. Condit), 1 specimen; Huachuca Mountains, Jan. 28, Feb. 12, and May 21 to July 3 (Price and Condit), 18 specimens; Chiricahua Mountains, March 21, April 14, and June 17 to July 24 (Price and Condit), 18 specimens; Graham Mountain, Aug. 7 (Price and Condit), 1 specimen; White Mountains, Aug. 1–4 (B. C. Condit), and Sept. 12, 7 specimens; Showlow, Aug. 22 (B. C. Condit), 2 specimens.

The series presents considerable variation in both external and cranial characters, but the variations are so inconstant, as shown by the large series from single localities, that it is difficult to consider them as not due to age and individual variation. Dr. Merriam has kindly sent me a number of specimens for examination, of what he considers to be true *N. mexicanus*, as restricted in his later papers, and I see no impropriety in referring all of the 58 specimens in the Price Collection to this form.

The coloration varies greatly with age and season. In fairly well-grown specimens the color of the upper parts ranges from a pale yellowish gray, more or less lined with black along the middle of the back, and with a decided wash of pale buffy on the sides (young adults) to a stronger yellowish gray quite heavily lined with black on the back, and with a stronger wash of buff on the sides (middle-aged specimens), and even to strongly rufescent brown above, heavily lined with black (old individuals). This variation is, however, obviously (in part) individual and not wholly due to age. The whiteness of the lower parts varies with age, season and the length of the coat, the plumbeous basal zone being much broader when the pelage is fully developed than at earlier stages following the molt.

In respect to the skull, the posterior branch of the intermaxillary usually extends considerably beyond the nasals, but in a small percentage of the skulls the intermaxillaries and nasals terminate on the same line, although in other respects the skulls are practically similar. The interparietal varies greatly with age, but to a rather less extent than in *N. micropus*[1]—about as in *N. floridana*.

The teeth vary of course with age in respect to the character of the enamel folds, but also in specimens of corresponding age. Thus M^1 shows generally two deep sulci on the antero-internal border, of similar depth and character in comparatively unworn teeth. In old examples the anterior of these two sulci becomes more or less obliterated, sometimes wholly so, through the growth and wearing down of the tooth, while in very much worn teeth the other may also disappear. In M_1 the change due to growth and wear in the front border of the tooth is even more striking than in M^1, the deep antero-internal sulcus seen in the young tooth becoming wholly obliterated in old age.

In M_3 the anterior loop is usually, or at least often, regularly convex on its anterior border, barely touching at its greatest convexity the tooth in front of it. In other specimens this anterior loop is flattened against the tooth in front, so that its front border is not only more or less flattened, but not unfrequently its antero-external border is developed into a slight angle, adding another (incipient) angle to the outer margin of the anterior loop.

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[1] See this Bulletin, VI, pp. 233-246, pl. iv.

Judging from the description, figure, and from topotypes of *Neotoma albigula* Hartley,[1] from Fort Lowell, it is not separable from *N. mexicana*. *N. pinctorum* Merriam and *N. m. bullata* Merriam are unrepresented in the present series.

"Wood Rats were abundant over the entire country visited, from the summits of the Huachuca, Graham and Chiricahua Mountains to the lower desert regions. About Fort Lowell they were exceedingly abundant, having numerous nests among cactus beds, brush fences, and in willows along the Rillito. They appear equally at home among rocks, cactus, or oak brush, for, wherever we were, traces of Wood Rats were common."—W. W. P.

NOTE ON ECCENTRICITIES IN THE TEETH OF NEOTOMA.—Several specimens of *Neotoma* in the Museum collection present eccentricities that seem worthy of note.

Neotoma californica *Price*.—One of two topotypes of this species presents the following extraordinary deviations in $M_{\overline{3}}$. It is an adult male (No. $\frac{6149}{4826}$) from Bear Valley, Cal. The last lower molar on each side has an extra enamel loop on the inner side, as though an attempt were made to reproduce the middle loop, normally developed in $M_{\overline{1}}$ and $M_{\overline{2}}$. A slight supernumerary cusp is also seen on the outer side of $M_{\overline{1}}$ and $M_{\overline{3}}$ of both rami, and two on the outer side of $M_{\overline{2}}$. They are all merely incipient points arising from the cingulum, but are not without morphologic interest. (See Fig. 12.)

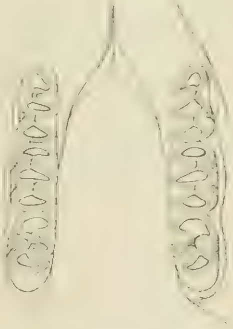

Fig. 12. *Neotoma californica.* Lower molar series, three times natural size.

Neotoma floridana (*Ord*). — A male from Enterprise, Florida, (No. $\frac{7860}{6215}$) has normal dentition, except with respect to $M_{\overline{3}}$ of the right side, which has an extra circular loop of enamel on the outer side opposite the middle of the tooth. When worn down it might give the appearance of an additional loop on the outer side of the tooth, but has

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[1] Proc. Cal. Acad. Sci., (2) IV, pp. 156–160, pl. xii.

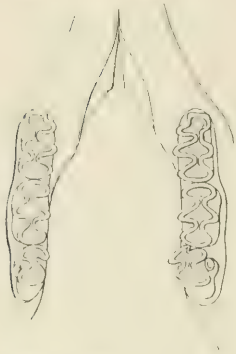

Fig. 13. *Neotoma floridana.* Lower molar series, three times natural size.

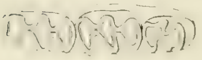

Fig. 14. *Neotoma floridana.* Left lower molar series, three times natural size.

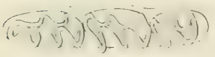

Fig. 15. *Neotoma micropus.* Left lower molar series, three times natural size.

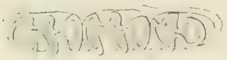

Fig. 16.

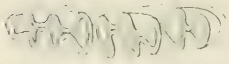

Fig. 17.

Figs. 16 and 17. *Neotoma cinerea occidentalis.* Left lower molar series, three times natural size.

now the form of a flat-topped or truncated cone. In the corresponding molar of the opposite side there is a tendency to the same condition. (See Fig. 13.)

Another specimen (No. $\frac{1855}{1128}$, ♀ ad., Gainesville, Fla.) has a well-developed angle at the antero-internal border of the posterior loop of M_3 (Fig. 14). In still another specimen (No. $\frac{4280}{3309}$, ♂ ad., Hancock Co., Miss.) a well-defined angle is developed at the antero-external border of the anterior loop of M_3.

A similar variation is seen in a specimen of *N. micropus* (No. $\frac{7234}{5838}$, ♂ ad., Rockport, Texas, Fig. 15). Less marked variations are not infrequent in *N. floridana*, *N. micropus* and *N. mexicana*, as already noted in regard to the latter.

In *N. cinerea occidentalis* this aberration is frequently well marked, as shown in No. $\frac{2096}{1463}$ (Fig. 16), in comparison with No. $\frac{}{1458}$ (Fig. 17). Fig. 17 may be considered as representing the more usual or normal form.

While these variations are in the main to be regarded as abnormal, they indicate tendencies to a more varied tooth-pattern, past or to come.

22. Onychomys torridus *Coues.* Arizona Scorpion Mouse. — To this species are referred 43 specimens, collected mostly within about 50 miles of the type locality (Camp Grant, Arizona), as follows: 26 specimens from Fairbank, Feb. 21 to March 14 (Price and Condit); 14 from Camp Lowell, Jan. 19 and March 8 to April 18 (Price and Miller); 3 from San Bernardino Ranch, March 27 and 31 and May 1 (B. C. Condit); and 1 from Phœnix, Dec. 10 (J. Diefenbach). Of the Fairbank series all but two are adult; of the Camp Lowell series 8 are adult and 5 are about half-grown young; of the three San Bernardino Ranch specimens, the two March examples are adult, and the May specimen is only about one-third grown.

The adults are for the most part very uniform in coloration. The white tip to the upper surface of the tail usually occupies the apical fourth or third, but is occasionally almost wholly lacking. The lower parts are pure white (not "yellowish white, or an extremely pale buff or fawn," as originally described from an alcoholic specimen), with more or less of the extreme basal portion of the fur pale plumbeous or ashy. The young are ashy gray above, more or less varied with blackish; below as in the adults.

The eight adults from Camp Lowell measure as follows: Total length, 148 (142–153); tail vertebræ, 52 (47–55); hind foot, 22 (19.5–22.5); ear, 17 (15–19).

The 24 adults from Fairbank average slightly smaller, as follows: Total length, 144 (134–157); tail vertebræ, 43 (40–49); hind foot, 22 (20–23.5); ear, 17.5 (16–18.5). In total length 5 exceed 150 and 5 fall below 140; in length of tail only 3 exceed 45 and only 5 fall below 42; in length of hind foot 5 exceed 23 and 3 fall below 21; in length of ear only 2 exceed 18 and only 3 fall below 17.

"This form appears to be abundant south of the Mogollon Mesa wherever there are sandy mesquite covered plains and river-bottoms. We found it abundant at Fort Lowell, Fairbank and Willcox. It lives in holes under bushes and brush-heaps, and is partially carnivorous, for we frequently found the stomachs filled with scorpions, insects, and the hair and flesh of mice. They would often drag off our traps containing small mammals. We sometimes found a trap containing a half-eaten mouse lodged in the opening of this animal's burrow."—W. W. P.

23. Onychomys leucogaster pallescens *Merriam.* DESERT SCORPION MOUSE.—A series of 7 specimens, 4 of them not quite adult, taken at Holbrook, Apache Co., Arizona, Aug. 26–29, by Messrs. Price and Diefenbach, are referable to Dr. Merriam's *O. pallescens*, which appears to be essentially a pale desert form of *O. leucogaster*. The 5 oldest specimens (mostly 'young adults') measure as follows: Total length, 145 (135–151); tail, 40 (37–45); hind foot, 21 (19.5–22.5); ear, 19 (16–20).

"This species was found only at Holbrook. It was common on the sandy flats along the little Colorado, having holes in the sand heaped about bushes. It is a powerful little rodent, and was troublesome in carrying off our traps and their contents—White-footed Mice and Pocket-mice. They have a very peculiar musky odor."—W. W. P.

24. **Peromyscus eremicus** (*Baird*). DESERT MOUSE.—This species is represented by 7 specimens—2 adults from Fairbank, Feb. 23–26; 1 adult from Fort Lowell, March 7; 2 adults from Phœnix, Dec. 12–14, and 1 adult and 1 nearly full-grown young from Oposura, Sonora, May 31. The young one has a fluffy fulvous patch on each side of the abdomen, and is otherwise strongly suggestive of *Hesperomys* (*Vesperimus*) *anthonyi* Merriam (Proc. Biol. Soc. Wash., IV, 1887, p. 5), based on a series of immature specimens from Fort Apache, Grant Co., New Mexico.

"Found sparingly at several places; three or four specimens were trapped by brush fences at Fort Lowell, and in open fields at Fairbank. Mr. Condit found a few about the buildings at San Bernardino Ranch, and in fields below the town of Oposura."—W. W. P.

25. **Peromyscus auripectus** *Allen*. SILKY CLIFF MOUSE.

Sitomys auripectus ALLEN, Bull. Am. Mus. Nat. Hist. V, 1893, 75. Bluff City, Utah.

Represented by 14 specimens from Holbrook, Apache Co., collected Aug. 26–29, by Messrs. Price and Condit. Two are quite young, 4 are adults, and the others 'young adults,' still in more or less grayish pelage. Only two show any trace of the salmon-colored pectoral spot, usually present in adults. The 4 adults of the series measure as follows: Total length, 192 (184–210); tail vertebræ, 100 (91–107); hind foot, 23 (22–24); ear, 20.5 (20–21).

This species has the soft, silky pelage, and nearly the size and proportions of *S. eremicus*, from which it is readily separable by its very hairy, heavily penicillate tail, and hairy heels, and when adult, by its lighter yellowish coloration above, and usually by the presence of a fulvous pectoral spot.

"We found this form not uncommon among the sandstone ledges and cliffs along the Little Colorado River at the town of Holbrook. We caught them readily in traps baited with rolled oats or raisins. In some places they undoubtedly inhabited the nests of *Neotoma* (sp.?)."—W. W. P.

26. **Peromyscus rowleyi** *Allen.* ROWLEY'S WHITE-FOOTED MOUSE.

Sitomys rowleyi ALLEN, Bull. Am. Mus. Nat. Hist. V, 1893, p. 76. Nolan's Ranch, Utah.

To this species are referred 2 specimens from Showlow, and 2 from the White Mountains, Apache Co., Arizona. All are adult, and were taken respectively Aug. 22 and July 28. They measure: Total length, 207 (198–210); tail vertebræ, 106 (104–107); hind foot, 22.7 (22–24); ear, 20 (19.5–21).

"Two specimens were taken at Showlow, just at the overlapping of the pine and juniper belts. Two were taken on White River, in the White Mountains, a few miles east from Fort Apache, July 27."—W. W. P.

27. **Peromyscus rowleyi pinalis** (*Miller*). MILLER'S WHITE-FOOTED MOUSE.

Sitomys rowleyi pinalis MILLER, Bull. Am. Mus. Nat. Hist. V, 1893, p. 331. Granite Gap, Grant Co., New Mexico.

This subspecies is represented by 132 specimens, of which 74 are from the Chiricahua Mountains, collected May 14 to July 21, by Price, Condit and Miller; 40 from the Huachuca Mountains, collected Jan. 28 to Feb. 20, and May 21 to May 27, by Price and Condit; 11 from Huasava Mountains, collected May 24–27 by B. C. Condit, and 6 from Oposura, Sonora, collected May 30 by B. C. Condit. The adults are very uniform in coloration, but the immature specimens present every phase from the ashy gray young, washed strongly with black on the back, to the fully adult. The adults, however, vary much in general size, in the relative length of the tail, and especially in the size of the ears, which, however, seem to keep pace with the general size in the increase with age from 'young adults' to very old adults.

A series of 46 adults from the Chiricahua collection measure as follows: Total length, 199 (185–225); tail vertebræ, 98 (87–115); hind foot, 22 (20–24); ear, 19.6 (17–24). In total length 4 exceed 220, and 12 fall below 190; in length of tail 7 exceed 110, and 8 fall below 95; in length of hind foot 8 exceed 23 and 3 fall below 21; in length of ear 9 exceed 20 and 8 fall below 19. The smaller specimens are in many instances not fully adult in size, though practically so in coloration.

The Huachuca series averages a little less, 16 adults measuring as follows: Total length, 192 (189–206); tail vertebræ, 92 (89–109); hind foot, 22 (20–24); ear, 19 (17–21). In total length 6 only exceed 200, but only 1 falls below 190; in length of tail only 1 exceeds 105 and 5 fall below 95; in length of hind foot only 1 exceeds 23 and 4 fall below 21; in length of ear only 1 exceeds 20 and only 3 exceed 19.

The Oposura series runs still smaller, 10 adults measuring as follows: Total length, 192 (184–195); tail vertebræ, 94 (90–99); hind foot, 21 (20–22); ear, 19.5 (17.5–20).

"This mouse is found in the region intermediate between [*Peromyscus leucopus*] *rufinus* of the higher altitudes and [*Peromyscus leucopus*] *arizonæ* of the plains. It was rarely found above 7500 or 8000 feet, and only at one place below 5000 feet. This was about 10 miles south of Oposura, Sonora, at an elevation of about 1000 feet. There Mr. Condit found it not uncommon among brush fences and brush heaps along cultivated fields. This, with two specimens of *P. eremicus*, were the only forms of *Peromyscus* found in the region. It has all the habits of the genus, being found everywhere, among rocks, brush heaps and logs, and is also very troublesome about camp and in the houses of miners and prospectors."—W. W. P.

28. **Peromyscus megalotis** (*Merriam*). LEAF-EARED CLIFF MOUSE.

Hesperomys megalotis MERRIAM, N. Am. Fauna, No. 3, 1890, p. 64. Black Tank, Desert of the Little Colorado, Arizona.

Represented by a single adult male, taken at Holbrook, Aug. 29, by Messrs. Price and Diefenbach. The measurements from the fresh specimen, as recorded on the label, are: Total length, 185 mm.; tail vertebræ, 90; hind foot, 25; length of ear, 28; height of ear, 28.

This specimen is slightly smaller than *P. megalotis*, as described by Dr. Merriam from the Little Colorado Desert, but is otherwise similar. On the other hand, it differs from a series of 8 specimens of *P. truei*, taken near the type locality in New Mexico, in being less yellow and more tawny, in its much larger ears, larger size, and longer tail. The 8 specimens of *P. truei* measure as follows: Total length, 177 (165–184); tail vertebræ, 87 (71–100); hind foot, 23 (22–23.6). The ears in *truei* average fully one-fourth smaller than in *megalotis*.

"A single specimen of this huge-eared mouse was caught in sandstone cliffs along the Little Colorado at Holbrook on Aug. 29. Specimens of *P. auripectus* were caught commonly within a few feet of this one."—W. W. P.

29. **Peromyscus leucopus sonoriensis** (*Leconte*). SONORA WHITE-FOOTED MOUSE.

Hesperomys sonoriensis LECONTE, Proc. Acad. Nat. Sci. Phila. VI, 1853, p. 413. "In provincia Sonoræ"=Santa Cruz, Sonora.[1]

Hesperomys sonoriensis BAIRD, Mam. N. Am. 1857, p. 474 (in part; only the Sonoran specimens); Mex. Bound. Surv. Zoölogy, 1859, Mam. p. 43.

Hesperomys (*Vesperimus*) *leucopus sonoriensis* COUES, Proc. Acad. Nat. Sci. Phila. 1874, p. 179 (in small part—only the Sonoran reference); Mon. N. Am. Roden. 1877, p. 79 (Sonoran reference only).

Sitomys americanus arizonæ ALLEN, Bull. Am. Mus. Nat. Hist. VI, 1894, p. 321.

In preparing the present paper it has seemed necessary to once more take up the question of Leconte's *Hesperomys sonoriensis*, in consequence of the light thrown upon the general subject of the short-tailed mice of the middle region of the continent by the very large series of these mice in the Price Collection, and from other sources, available for study in the present connection. As a result of this revision of the subject, I am led to consider that the form recently described by me as *Sitomys americanus arizonæ* is to be taken as the true *sonoriensis* of Leconte, using the name in a restricted sense for the short-tailed grayish brown form of *Peromyscus* of the open plains and semi-desert areas of southern Arizona and adjoining portions of northern Sonora.

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[1] "In Sonora, south-southwest [lege south-southeast] of Tucson. About lat. 31° 00′, long. 122° 00′." *Baird*, Mam. N. Am., p. 713.

As is well known, the type locality of *Hesperomys sonoriensis* Leconte was Santa Cruz, Sonora, and that the type itself was an immature example in the plumbeous phase of pelage, and thus not readily distinguishable from specimens of the short-tailed group of corresponding age from other localities further north. Hence, Professor Baird, in 1857, applied the name collectively to all of the short-tailed mice from the "Upper Missouri, and Rocky Mountains to El Paso and Sonora." In this he was followed by Dr. Coues in 1874 and 1877, and by authors generally till 1890, when Dr. Mearns[1] "found that no less than five very distinct types are represented from the interior region of North America, viz.: a very dark arctic race; a pale grayish form from the treeless plains of the north; a more reddish or cinnamon-colored race from the treeless regions of the south; a darker and browner southern alpine form; and a pallid race from the desert regions of California and Arizona." Three of these had already received names; to the other two new names were given, only one of which (*Hesperomys leucopus deserticolus*) requires consideration in the present connection. Dr. Mearns, however, redefined the other three, and the types of his diagnoses are before me. With Dr. Mearns's material in hand, I am able to intelligently consider his work and allocate the forms he recognized. Unfortunately the name *sonoriensis* was restricted to the "darker and browner southern alpine form," described soon after by Dr. Merriam as *Hesperomys leucopus rufinus*,[2] and what was then and subsequently recognized as *sonoriensis* by other authors was re-named *deserticolus*. I now propose to restrict *sonoriensis* to the form I recently named *arizonæ*, and to let *deserticolus* stand for the "pallid race from the desert regions of California and [immediately contiguous desert regions of] Arizona," which seems to be clearly separable from the *sonoriensis* (as now restricted) of southern Arizona and northern Sonora.

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[1] Bull. Am. Mus. Nat. Hist., II, Feb., 1890, p. 284–287.
[2] N. Am. Fauna, No. 3, Aug., 1890, p. 65.

My *Sitomys americanus arizonæ* (now *Peromyscus leucopus sonoriensis*) was based on a series of 42 specimens taken at Fairbank, Cochise Co., Arizona, Feb. 22 to March 15, 1894, by Messrs. Price and Condit. To the same form are referred 26 specimens, mostly immature, from San Bernardino Ranch, collected by Mr. B. C. Condit, March 21 to May 4. Also a specimen taken at Fort Lowell, Jan. 5; another taken at Willcox, July 15; and another from Fronteras, Sonora, taken May 16, also by Mr. Condit. The Willcox specimen is very gray and faded; the Fronteras specimen is like many of the examples from Fairbank.

Nearly all of these specimens came from within 30 to 50 miles of Santa Cruz, Sonora, the type locality of *sonoriensis*.

"This mouse was abundant at Willcox, Fairbank and San Bernardino Ranch, having habits like those of *S. sonoriensis* [=*P. leucopus deserticolus*], though at Fairbank some were trapped in boggy patches of tule."—W. W. P.

30. **Peromyscus leucopus deserticolus** (*Mearns*). DESERT WHITE-FOOTED MOUSE.

Hesperomys leucopus deserticolus MEARNS, Bull. Am. Mus. Nat. Hist. II, No. 4, Feb. 1890, p. 285. Type, No. 1175, Am. Mus., ♂ ad., Mojave Desert, California; F. Stephens.

Hesperomys leucopus sonoriensis MERRIAM, N. Am. Fauna, No. 3, Sept. 1890, p. 66. (Only in part of previous authors.)

Vesperimus americanus sonoriensis ALLEN, Bull. Am. Mus. Nat. Hist. III, Aug. 1891, p. 302.

To this form I refer a series of 18 specimens from Holbrook (Aug. 26–29), and 6 specimens from Showlow (Aug. 20–22). Two of the Holbrook specimens (Aug. 23) are in the light reddish phase of coloration characteristic of autumn and winter, of which others show slight traces. A few are in the dusky ashy pelage of the young, but the greater part present a brownish mouse-color tint, much like that of the winter pelage of *sonoriensis*. A series of 12 adults from Holbrook measure as follows: Total length, 154 mm.; tail vertebræ, 64; hind foot, 20; ear, 18.

"This was the most abundant mammal on the sandy flats about Holbrook, where it was associated with *Perognathus* and *Onychomys*. All three genera frequently have holes under the same bush. A few specimens were found at the edge of the pine belt below Showlow. This species was not found south of the great San Francisco or Mogollon divide."—W. W. P.

31. Peromyscus leucopus rufinus (*Merriam*). Alpine White-footed Mouse.

Hesperomys leucopus rufinus Merriam, N. Am. Fauna, No. 3, 1890, p. 65, pl. iii, figs. 5–8. San Francisco Mountain, Arizona.
Sitomys sonoriensis Allen, Bull. Am. Mus. Nat. Hist. V, 1893, p. 74. (Not typical.)

To this subspecies I refer all of the mountain races of the short-tailed *Peromyscus* represented in the present collection. Unfortunately the several series are not all comparable as regards season and condition of pelage. They include (1) a series of 68 specimens from the White Mountains, taken by Mr. B. C. Condit, Aug. 2–18, and 4 taken Sept. 2–18; (2) a series of 25 specimens from the Graham Mountain, taken by Messrs. Price and Condit, July 18–19; (3) a series of 89 specimens from the Chiricahua Mountains, taken by Messrs. Price and Condit, June 11 to July 9; forming a total of 182 specimens. I would also now refer to the same form the large series (130 specimens) collected by Mr. Charles P. Rowley in the mountains of Colorado and New Mexico, which I recently referred (this Bulletin, V, 1893, p. 74) provisionally to *Sitomys sonoriensis*. There are slight shades of difference between the series from the different localities represented, but there is also such a wide range of individual variation in color, size and proportions, and such an endless and complicated variation resulting from season and age, that apparently nothing is to be gained by attempting to recognize in nomenclature the slight average differences in coloration or other features that may possibly exist in the various more or less isolated mountain ranges of Arizona, New Mexico and adjoining regions. This is at least my present view of the case, with some 600 specimens of the *sonoriensis* group before me for examination. With larger series from these and numerous additional localities, collected throughout the year, it might be possible to predicate slight shades of difference for each isolated area, but the practicability of attempting such fine discriminations must be left to future research, and more abundant and better material, for determination.

The White Mountain series seems not to differ appreciably from specimens of *rufinus* from the San Francisco Mountains, the type locality of the subspecies. They are mostly immature or in changing pelage, but a considerable number have so far acquired the fall dress as to show satisfactorily the deep tawny brown characteristic of typical *rufinus*. A series of 18 fully adult specimens give the following measurements: Total length, 153 (144–164) mm.; tail vertebræ, 61.7 (52–69); hind foot, 19.6 (18–20); ear, 18.3 (17–19).

The adults of the Graham Mountain series are in worn, transition pelage, and present, with few exceptions, a broad blackish dorsal area, with the rump and sides tawny brown, paler and more mixed with blackish than the White Mountain series, apparently a seasonal feature. A series of 16 adults average slightly larger than the adults of the White Mountain series, measuring as follows: Total length, 159 (150–170); tail vertebræ, 68 (65–73); hind foot, 21.7 (21–22.5); ear, 18 (17–20). This is, hence, a large form, and should the dark band along the dorsal region prove a fairly constant feature at all seasons, would well merit recognition in nomenclature. But this does not seem probable, as one specimen shows a narrow transverse line of tawny red hairs behind the shoulders, and another has the whole top of the head and nape red—remnants, evidently, of a tawny red pelage of earlier date.

The Chiricahua Mountains series is quite similar to the Graham Mountain series; the adults are mostly in change, blackish along the median line of the back (but not so uniformly so, the blackness of this area appearing often in patches), and of a paler tawny on the sides of the body and lower back than the White Mountain series. In size they are just intermediate between the White Mountain and Chiricahua series, 66 adults measuring as follows: Total length, 155 (142–170); tail vertebræ, 65 (53–75); hind foot, 21 (19–22.5); ear, 19 (17.5–20.5).

A series of 16 specimens of *rufinus* from the type locality, as given by Dr. Merriam (N. Am. Fauna, No. 3, Aug., 1890, p. 66), measures as follows: Total length, 160 (150–170); tail vertebræ, 68 (56–75); hind foot, 20 (19–21).

A series of 20 adults from La Plata, New Mexico (altitude, 6100 feet), measures as follows: Total length, 153 (145–179); tail vertebræ, 68 (60–79); hind foot, 21 (19–22).

For convenience of comparison, these measurements may be tabulated as follows:

MEASUREMENTS (AVERAGES AND EXTREMES) OF 136 SPECIMENS OF *Peromyscus leucopus rufinus.*

Locality.	No. of specimens.	Total length.	Tail vertebræ.	Hind foot.	Ear.
San Fran. Mts..	16	160 (150–170)	68 (56–75)	20 (19–21)	
White Mts.. ..	18	153 (144–161)	61.7 (52–69)	19.6 (18–20)	18.3 (17–19)
Graham Mts....	16	159 (150–170)	68 (65–73)	21.7 (21–22.5)	18 (17–20)
Chiricahua Mts.	66	155 (142–170)	65 (53–75)	21 (19–22.5)	19 (17.5–20.5)
La Plata, N.M.[1]	20	153 (145–179)	68 (60–79)	21 (19–22)	

From the above it appears that the White Mountain series averages a little smaller than the others, but it is geographically most nearly related to typical *rufinus*, as it is also in coloration, as nearly as can be judged from the material at hand.

"This form belongs to high elevations, and was exceedingly abundant on the summits of the Chiricahua and Graham Mountains, where they were the only *Sitomys* obtained. In the White Mountains it was abundant from the summit down as low as 6500 feet, but in the Chiricahua Mountains it was not found below 8000 feet. It is found everywhere—in boggy flats filled with fallen logs, on bare, rocky hillsides, in thick brush—equally at home."—W. W. P.

32. **Reithrodontomys megalotis** (*Baird*). BIG-EARED HARVEST MOUSE.—Five specimens from Fairbank, March 2–14 (Price and Condit), seem distinctly referable to Baird's *R. megalotis*, the type locality of which is not far to the southeastward of Fairbank. Three of the specimens are adult, and give the follow-

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[1] The apparently relatively longer tail in the La Plata series is probably due to difference in methods of measuring.

ing measurements: Total length, 143 (141–146); tail vertebræ, 66 (62–72); hind foot, 18.5 (18–19); ear, 14 (14–14).

I also refer to this species a single adult male from San Bernardino Ranch (April 20, B. C. Condit), which differs from the others in being somewhat larger, but especially in having much larger ears. This specimen measures: Total length, 150; tail, 74; hind foot, 19.5; ear, 17.5.

"This species was found at Fairbank, in marshy places along the San Pedro River, where five specimens were trapped, March 2–14."—W. W. P.

33. **Reithrodontomys fulvescens** (*Allen*). SONORAN HARVEST MOUSE.

Reithrodontomys mexicanus fulvescens ALLEN, Bull. Am. Mus. Nat. Hist. VI, 1894, p. 319.
Reithrodontomys fulvescens ALLEN, *ibid.* VII, May, 1895, p. 138.

There is at present nothing to add to the accounts already given (l. c.) of the three adult specimens from Oposura on which this species was based.

"This species was taken by Mr. Condit, May 31, ten miles south of Oposura, Sonora, Mexico, in the valley of the Yaqui River. They were found along brush fences and shrubby mesquite trees."—W. W. P.

34. **Reithrodontomys arizonensis** *Allen*. CHIRICAHUA HARVEST MOUSE.

Reithrodontomys longicauda ALLEN (nec BAIRD), Bull. Am. Mus. Nat. Hist. VI, 1894, p. 320 (in text).
Reithrodontomys arizonensis ALLEN, *ibid.* VII, May, 1895, p. 134.

The 5 specimens (of which 4 are adult) on which this species is based, are from the Chiricahua Mountains (July 7–9, B. C. Condit). At first they were provisionally referred to *R. longicauda* of California, with which they have many points of relationship. The 4 adults measure as follows: Total length, 149 (145–152); tail vertebræ, 78 (74–80); hind foot, 17 (16–18); ear, 14 (13.5–14).

"Five specimens of this species were trapped on Rock Creek, in the Chiricahua Mountains, July 7–8, at an elevation of about 8000 feet. Two were in rocks and dry soil away from the bed of the creek, and the others were caught under logs and brush near the water."—W. W. P.

ADDITIONAL NOTE ON REITHRODONTOMYS.—I received from Dr. C. Hart Merriam, just too late for notice in the preceding paper on the genus *Reithrodontomys* (antea, pp. 107–143), some forty specimens of this genus, representing three species and various localities. Among them is a series of 10 specimens from Mason, Mason Co., Texas, and one or two specimens from Gainesville, Cooke Co., Texas. These localities are of special interest, as they indicate the probable continuous distribution of the genus southward throughout the greater part of Oklahoma, the Indian Territory and Texas.

The specimens from Gainesville and Mason, Texas, seem distinctly referable to the *R. dychei* group, and, judging from present material, are not even subspecifically separable from Kansas specimens. The Mason specimens are rather small, but as most of them are more or less immature, their exact status may be left for future decision. These localities thus extend the distribution of *R. dychei* from 200 to 500 miles south of its previous known range—from southeastern Kansas to west-central Texas, or to within about one hundred miles of the known northern limit of *R. mexicanus intermedius*.

35. **Mus musculus** *Linn.* HOUSE MOUSE.—Represented by 18 specimens: 1 from Holbrook, 1 from Showlow, 1 from Fort Lowell, 1 from Willcox, 6 from Fairbank, 1 from the Chiricahua Mountains, and 7 from Phœnix.

"The House Mouse was found to be common in several localities, as Fort Lowell, Holbrook, Fort Apache, Fairbank, Willcox, and any place where much teaming was done. A single specimen was caught at a house in the Huachuca Mountains. Three years before a wagon load of seed grain had been brought there, and of two house mice nesting in the grain one had escaped. The one I caught was in all probability the one that escaped."—W. W. P.

36. Cynomys arizonensis *Mearns.* ARIZONA PRAIRIE DOG.

Cynomys arizonensis MEARNS, Bull. Am. Mus. II, No. 4, 1890, p. 305. Near Willcox, Cochise Co., Arizona.

Represented by a single specimen (♂ ad.) from the Huachuca Mountains, taken Jan. 28 (Price and Condit).

"A single specimen was shot January 28, on the plain at the base of the Huachuca Mountains. It was a warm day after a cold rain, and the animals were scratching out their burrows, and feeding on the dwarfed grass roots. We saw about twenty, and, by the number of hillocks, estimated the colony to number about 200 individuals. To the next town east it was nearly a dozen miles. Old settlers know of a time when no Prairie Dogs could be found about the Huachuca Mountains. These people thought that the dogs had emigrated from northern Sonora, Mexico. In the Sulphur Spring and San Simon Valleys, Prairie Dogs are found in numerous colonies, especially about Willcox and on the plain along the east base of the Graham Mountain. They evidently do not hibernate at all during the winter. *Cynomys* are found in large colonies on the Ash Fork plains north of the Gila Range.

"The *Cynomys* found about Snowflake and Holbrook are probably *Cynomys gunnisoni*. In places large colonies were found, but unfortunately no specimens were obtained."—W. W. P.

37. Anisonyx[1] (Otospermophilus) grammurus (*Say*). LINE-TAILED SPERMOPHILE.—Represented by 1 specimen from Fairbank (♂ ad., March 1, Price and Condit); 3 from the Chiricahua Mountains (2 ♂♂, 1 ♀, all adult, April 17 and May 29, W. W. Price); 1 from Fort Lowell (♀ ad., March 18, L. H. Miller); 2 from the Huachuca Mountains (♂ and ♀ ad., June 18 and 21, L. Miller); and 1 from the White Mountains (Cooley's Ranch, Sept. 15). Total, 8 specimens.

"This is the common ground squirrel of Arizona; it is found everywhere over the entire region up to about 9000 feet. At Fort Lowell, during the summer of 1892, it was common in brush fences, and many had their dens under the roots of cottonwood and walnut trees. They were injurious to the growing crops of the Mexican settlers along the Rillito. I did not notice any during my stay at Fort Lowell in January, 1894. It is probable that they hibernate during the colder part of the year, as the first specimens seen were on a warm day, Feb. 7, at the mouth of a cañon in the Huachuca Mountains.

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[1] *Cf.* Merriam, Science, new Ser., I, No. 1. p. 18, Jan. 4, 1895.

"At our camp in the Huachuca Mountains, during 1893, they were very troublesome. A few minutes after our leaving the cabin they would swarm down from the cañon sides and carry off everything that was not securely boxed—bread, pork, dried fruit and potatoes; nothing came amiss to them. On our return they would scatter to the rocks, and for long after there would be a chorus of shrill chattering calls. At Showlow and Snowflake they were troublesome to the farmers, but were got rid of by poison. At Cooley's they were quite common among rocks and about fences."—W. W. P.

38. Anisonyx (Ictidomys) tereticaudus (*Baird*). ROUND-TAILED SPERMOPHILE.—Represented by 13 specimens taken at Fort Lowell, by L. H. Miller, March 7 to April 30. Of this series 3 are males and 10 are females; all are fully adult. The early March specimens show no signs of molting; the pelage above is rather short and close, but soft; below it is thinner, longer, much softer, dusky or blackish basally, and whitish at the ends of the hairs. The late April specimens have completed the spring molt. In these the pelage is everywhere short and close, slightly rufescent or of a pale cinnamon cast above, and clear silvery white below, becoming blackish as the hairs increase in length.

The 3 males measure as follows: Total length, 238 (231–251); tail vertebræ, 71 (65–78); hind foot, 33.5 (32–35); ear, 6. The 10 females measure: Total length, 243 (227–263); tail vertebræ, 79 (70–92); hind foot, 35.2 (33–37); ear, 5.6 (5–6.5).

"Found only at Fort Lowell, where they were abundant everywhere. They are shy and in such color harmony with the soil that they might pass for a rare species upon casual observation. Throughout May and June, 1893, I had an opportunity for observing them at leisure. It was hard to come upon them unawares, but by secreting myself in bushes near their burrows, I often saw them come out, ten or a dozen, one after another, and feed upon small seeds and mesquite beans. They would hurry silently away to their holes at the first noise. They are silent animals, rarely uttering an alarm note. The young are much less shy, and can sometimes be surprised away from their holes and caught in the hand. My companion had a pet one that ran at will about the rooms and fed greedily on raisins and rolled oats. It slept at night in the warm ashes of the fireplace."—W. W. P.

39. Anisonyx (Xerospermophilus[1]) canescens (*Merriam*). HOARY SPERMOPHILE.—Represented by a single specimen from Willcox, the type locality of the species. It is an adult female, taken July 15, by Price and Condit. It gives evidence of having recently nursed young. It measures as follows: Total length, 220; tail vertebræ, 64; hind foot, 34; ear, 10.

"A female of this species was taken at Willcox, Arizona, July 15, in a thicket of mesquite bushes. Several others were noticed."—W. W. P.

40. Anisonyx (Xerospermophilus) spilosoma macrospilotus (*Merriam*).—Four specimens are provisionally referred to this subspecies, originally based (N. Am. Fauna, No. 4, 1890, p. 38) on specimens from Oracle, Pinal County, Arizona. Two, both adult males, are from Fairbank (Feb. 23 and March 11, Price and Condit); one, an adult male, is from the San Bernardino Ranch (May 4, B. C. Condit), and the other from the Chiricahua Mountains (May 4, W. W. Price). This last is indistinguishable from the Fairbank specimens; the San Bernardino Ranch specimen has a slightly hoary tint, due perhaps to the incoming post-breeding pelage. Hence in general effect it somewhat resembles the Willcox specimen, referred above to *S. canescens*.

The four specimens measure as follows:

	Sex.	Total length.	Tail vertebræ.	Hind foot.	Ear.
Fairbank	♂	195	60	33	9
"	♂	198	61	31	
Chiricahua Mts.	♂	210	64	32.5	8.5
S. B. Ranch	♂	217	72	35	8

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[1] *Cf.* Merriam, Proc. Biol. Soc. Wash., VII, 1892, p. 27, footnote.

"This species is rather common about Fairbank among mesquite thickets in sandy soil. The animals are shy, and in habits are much like *A. tereticaudus.* Their burrows are often placed at the roots of mesquite bushes, the beans of which form a large part of their food. Along the west base of the Chiricahua Mountains in the Sulphur Spring Valley are several large colonies. Here they have hillocked towns not unlike those of the Prairie Dogs. They can often be seen sitting upright above their burrows. A single specimen was taken from a small colony in the Sulphur Spring Valley. It is probable that the habitats of this form and that of *A. cryptospilotus* overlap, for only a level plain of 20 or 30 miles separates the two forms. Mr. Condit found a small colony at San Bernardino Ranch and collected a single specimen."—W. W. P.

41. **Anisonyx (Xerospermophilus) cryptospilotus** (*Merriam*).—A single specimen, ♀ ad., from Holbrook (Aug. 27, Price and Diefenbach) is provisionally referred to this species. It is very pale in coloration, with very faint whitish spots. Total length, 216; tail vertebræ, 65; hind foot, 31.5; ear, 9.

"A single specimen was taken on the sandy alkaline plain bordering the Little Colorado River at Holbrook, August 28. No others were seen."—W. W. P.

42. **Anisonyx (Ammospermophilus[1]) leucurus cinnamomeus** (*Merriam*). WHITE-TAILED CHIPMUNK.—One specimen, ♂ ad., Holbrook, August 28, Price and Diefenbach.

"We trapped a single specimen in the sandstone cliffs near Holbrook. It was in what I supposed to be a nest of *Neotoma.* No others were seen."—W. W. P.

43. **Anisonyx (Ammospermophilus) harrisii** (*Aud. & Bach.*). HARRIS'S CHIPMUNK.—Six specimens, of which 5 are from Fort Lowell (Jan. 8–11, Price and Condit), and 1 from Phœnix (Dec. 12, J. Diefenbach).

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[1] *Cf.* Merriam, Proc. Biol. Soc. Wash., VII, 1892, p. 27, footnote.

"This species is rather common in the lower desert region of southern Arizona. It was taken at Fort Lowell on rocky hills, east of the Rillito, on January 8. Several specimens were seen, and a female containing nine embryos was obtained. On the cactus-covered plain stretching down to the Gila River from Graham Mountain, I found this species abundant on July 20. They were feeding on the seeds of the screw-pod mesquite, and one specimen shot had his cheek pouches distended with the shelled beans. Owing to the excessively hot weather no specimens were preserved."—W. W. P.

44. **Tamias lateralis** (*Say*). SAY'S GROUND SQUIRREL.—Represented by 17 specimens, all taken in the White Mountains in August and September (Aug. 2–12, Price and Condit, 14 specimens; Sept. 4–13, Diefenbach, 3 specimens). All are adult except two, of which 9 are males and 8 are females. The August females are still in worn breeding dress, with traces of the incoming post-breeding pelage. The August males are somewhat advanced in molt, but in none is it more than half completed; the September specimens have all completed the molt.

Six fully adult males measure as follows: Total length, 270 (250–279); tail vertebræ, 94 (80–109); hind foot, 41 (40–43); ear, 21.5 (20–23). In one specimen the tail vertebræ measure 109 mm.—11 mm. longer than in any other specimen in the series.

Four old females give the following: Total length, 271 (255–288); tail vertebræ, 88.5 (85–92); hind foot, 41 (41–42); ear, 22 (21–24).

"This species was common about Cooley's Ranch, where they frequented rock piles, rubbish heaps and fallen logs; some even had holes in the open woods. They were very tame, sometimes coming into my camp picking up crumbs. They do not resemble the *Tamias* proper in habits, but, being terrestrial, they are more like the small Spermophiles. Mr. Condit found them to be common in the White Mountains to near the summit."—W. W. P.

45. **Tamias dorsalis** *Baird*. GILA CHIPMUNK.—Represented by 105 specimens, 3 of which are from the Santa Catalina Mountains (Jan. 16), 2 from the Graham Mountain (July 19),

and 100 from the Chiricahua Mountains. Of the latter, 5 were taken March 29 to April 6, and the remainder May 31 to August 16. The sexes are not quite equally represented, there being 43 males and 57 females. Nearly all are adult.

The measurements of 22 adult males and 28 adult females furnish the following summary: 22 males—total length, 224 (215–236); tail vertebræ, 100 (90–110); hind foot, 34 (32–36); ear, 21 (19–22): 28 females—total length, 233 (220–247); tail vertebræ, 103 94–114); hind foot, 34 (32–36); ear, 21 (19–23).

Three males (14 per cent.) and 10 females (36 per cent.) reach or exceed 235 mm. in total length; 3 males and 13 females reach or exceed 105 mm. in length of tail vertebræ.

"I found *Tamias dorsalis* in the Chiricahua, Santa Catalina and Graham Mountains, and in the lower parts of the region drained by the Salt and White Rivers, which drain into the Gila. On the 14th of January, I shot three specimens high up in the Santa Catalina Mountains. One was at an elevation of nearly 8000 feet, and close to a snow field. This was enough to show that the species does not hibernate except perhaps for a few weeks during a heavy snow-fall. In the Chiricahua Mountains I found it continuously after my arrival there on March 19. It was common from the scrub-oaks at the base to the thick firs and aspens on the very summit, 10,000 feet elevation. In the Graham Range the species was common from the base to the summit. Two specimens were taken in fir woods at about 10,000 feet above sea level. In the open pine woods south of Fort Apache, I noticed this species several times. At Fort Apache they were abundant in the lava cliffs along White River, often venturing to the row of officers' quarters, placed close to the bank of the river. On warm days in August I have sometimes seen three or four together, sunning themselves on the ridge of a deserted house.

"In the Chiricahua Mountains, I had the ortoppunity to study them for several months. They were generally distributed in rocks, brush fences, thick woods and brushy hillsides. They are rather shy animals, not commonly found in trees, as is *Tamias cinereicollis*; they have the usual chipmunk call. On warm days in June they were very abundant in Morse's Cañon in the Chiricahua

Mountains. Often as many as ten or twelve could be seen at once, playing among the rocks near my camp.

"One of the odd facts of distribution is that in the Huachucas the genus *Tamias* is entirely wanting, though the mountains in every particular appear to be as favorable a habitat as either of the other ranges mentioned."—W. W. P.

46. **Tamias cinereicollis** *Allen.* San Francisco Mountain Chipmunk.—All of the 56 specimens were taken in the White Mountains August 6–20 and Sept. 2–19. Of this August[1] series, 30 are males and 17 are females; about one-half are fully adult, and the remainder immature, including a few less than half grown. The females average slightly larger than the males, as shown by the following summary of measurements: 16 males—total length, 217 (205–228); tail vertebræ, 96 (90–103); hind foot, 33 (32–36); ear, 19 (18–21): 12 females—total length, 224 (207–238); tail vertebræ, 99 (90–106); hind foot, 33 (31–34); ear, 19.5 (17–21).

Five (17 per cent.) of the males and 6 (30 per cent.) of the females exceed 223 mm. in total length; 5 males (17 per cent.) and 4 females (25 per cent.) reach or exceed 100 mm. in length of tail vertebræ.

"Found only in the White Mountains and in the heavy pine timber about Cooley's Ranch. Mr. Condit found it on the peaks of the White Mountains up to timber line. *T. cinereicollis* is arboreal, and rarely seen on the ground or in rocks. It is an active species, and has a rather loud, sharp call. It is confined to the pine and fir zone of the San Francisco plateau, and reaches the White Mountains from the Mogollon plateau. Near Cooley's the ranges of this species and that of *Tamais dorsalis* overlap, the former occupying a strip of country from 15 to 25 miles broad. At Cooley's nearly all the specimens taken were in oak trees, and they evidently feed largely on the acorns."—W. W. P.

47. **Sciurus hudsonicus mogollonensis** *Mearns.* Mearns's Chickaree.—This form of the Chickaree is represented by 8

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[1] The September specimens are not labeled as to sex.

specimens, all adult females, from the White Mountains (Aug. 9–12, B. C. Condit). They seem quite indistinguishable from the series of 12 specimens collected by Dr. Mearns in the San Francisco Mountains, on which the subspecies was originally based. The White Mountain series measures: Total length, 322 (310–336); tail vertebræ, 131 (126–138); hind foot, 51 (49–53); ear, 26.5 (24–28).

"Abundant in the White Mountains above 7000 feet; probably extends to the limit of the fir zone. A noisy species, feeding largely on the cones of Douglass fir."—W. W. P.

48. **Sciurus hudsonicus grahamensis** *Allen.* MOUNT GRAHAM CHICKAREE.

Sciurus hudsonicus grahamensis ALLEN, Bull. Am. Mus. Nat. Hist. VI, 1894, p. 350. (Separates issued Dec. 7, 1894.)

There is at present nothing to add to the description (l. c.) of this form, based on 3 specimens from Graham Mountain.

"This very restricted species is confined to the fir zone on the summit of Graham Mountain. Three specimens were obtained in dense fir woods on Aug. 17 and 19. Others were heard chattering."—W. W. P.

49. **Sciurus aberti** *Woodh.* ABERT'S SQUIRREL.—Represented by 6 specimens (1 ♂, 5 ♀ ♀, all adult), 5 of which were taken in the White Mountains, Aug. 1–8 and Sept. 17 (Price and Diefenbach), and 1 at Showlow. Four of the six measure as follows:

Sex.	Total length.	Tail vertebræ.	Hind foot.	Ear.
♂	500	238	65	41
♀	495	232	73	43
♀	515	235	75	43
♀	521	229	62	45
♀	498	221	63	41

"This handsome squirrel was common in the White Mountains, ranging from about 6000 feet up into the spruce belt to about 9000 feet. It was more abundant between 7000 and 8000 feet elevation. It has a loud 'barking' call and feeds on cones of *Pinus ponderosa*, and usually builds its nest of branches in some lightning-blasted tree."—W. W. P.

50. Sciurus arizonensis *Coues.* ARIZONA SQUIRREL.—Represented by a single worn specimen from Fort Apache, taken by Mr. Price.

"A single specimen was shot in pine and oak woods near Fort Apache on Aug. 20. It is probably found all through the lower pine zone, usually not overlapping the range of *S. aberti.*"—W. W. P.

51. Sciurus arizonensis huachuca *Allen.* HUACHUCA SQUIRREL.

Sciurus arizonensis huachuca ALLEN, Bull. Am. Mus. Nat. Hist. VI, 1894, p. 349. (Separates published Dec. 7, 1894.)

In addition to the 4 specimens on which this subspecies was based (l. c.), 3 have been since received, all being from the Huachuca Mountains. These additional specimens, taken June 9 and 19 and July 3, by Mr. L. H. Miller, are in worn summer pelage, but otherwise similar to those already described.

"Common in the Huachuca Mountains from the highest peaks down to the base of the range, where I have found it feeding on walnuts in the cañons and ravines. During the summer of 1893, with Mr. R. L. Wilbur, I found it abundant in Ramsey Cañon, which that year had a good crop of walnuts. Often we would see two or three in one tree feeding on the partially ripe nuts. A series of over 40 specimens was secured. These squirrels often run upon the ground, but like best to jump from branch to branch. They have a call similar to that of Abert's Squirrel. They breed early, for by the middle of July we obtained young, nearly full grown."—W. W. P.

52. Nyctinomus nevadensis (*H. Allen*). NEVADA BAT.—One specimen from the Chiricahua Mountains, as already recorded (this Bulletin, VI, 1894, p. 326).

"A single specimen, a female, was taken on the ridge of the Chiricahua Mountains at a small meadow called Fly's Park, at about 9500 feet, on the evening of June 22. Another large bat, supposed to be of this species, was seen on the same evening. These bats were associated with large numbers of *N. brasiliensis*, and were flying from a dark cañon on the eastern slope of the range over the summit to the west."—W. W. P.

53. **Nyctinomus brasiliensis** *I. Geoff.* House Bat.—Represented by 7 specimens, collected as follows: Huachuca Mountains, ♀ ad., May 22 (Price and Miller); Chiricahua Mountains, 1 male and 5 females, all adult, June 19–23 (Price and Condit).

The single male measures: Extent, 305; length, 102. The females range as follows: Extent, 298 (290–308); length, 97 (94–100).

"These bats were abundant on the summit of the Chiricahua Mountains during June. From soon after sunset until too dark to see, a steady procession passed the summit from east to west. They had a rather steady flight, and did not apear to be feeding. Although they always appeared to fly from east to west, in the evening, it is likely they had a breeding place in the jagged cliffs on the east slope of the mountains, and returned there before daybreak, after feeding on the west slope. A single specimen was caught in a damp tunnel in the Huachuca Mountains on May 22. This species was exceedingly abundant at Fort Lowell through the month of May. Many specimens were taken in the cornice of the deserted hospital building."—W. W. P.

54. **Atalapha borealis** (*Müller*[1]). Red Bat. Represented by an adult female and two nursing young, taken in the Chiricahua Mountains, June 27 (Price and Condit).

"A nursing female with two young a few days old, was taken from the thick foliage of a peach tree at Wilgus P. O., at the west base of the Chiricahua Mountains, on June 26."—W. W. P.

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[1] *Cf.* Rhoads, Am. Nat., XXVIII, June, 1894, p. 523; Reprint of Ord's Zoöl., 1894, App., p. 3.

55. **Atalapha cinerea** (*Beauv.*). HOARY BAT.—A specimen labeled: "Found on a wire fence, Huachuca Mountains, June 15, L. Miller," consists of the complete skeleton and the hair.

"A single specimen was found dead on a fence in Miller's Cañon in the Huachuca Mountains in May. This species was found to be not uncommon in the range of mountains during the summer of 1893."—W. W. P.

56. **Vesperugo hesperus** (*H. Allen*). PIGMY BAT.—One specimen, ♀ ad., Chiricahua Mountains, June 2 (W. W. Price). Expanse, 212; length, 77.

"A single specimen was shot flying over an alfalfa field at the mouth of Rucker Cañon on June 2. A small bat, supposed to be this species, was one of the earliest to be seen evenings at my camp in Rucker Cañon. They lived in cliffs on the cañon side and flew high, with a wavering flight."—W. W. P.

57. **Adelonycteris fusca** (*Beauv.*). BROWN BAT.—Represented by 38 specimens, nearly all adult, and equally divided as to sex. They were collected as follows: Chiricahua Mountains, May 31 to July 11 (B. C. Condit), 12 males, 18 females = 30 specimens; White Mountains, August 7–16 (W. W. Price), 6 males and 2 females. With the exception that the younger specimens are darker and smaller than the others, there is very little variation in coloration or size, there being no appreciable sexual variation in color, and very little in size. The females average slightly larger than the males, as shown by the following summary of measurements: 17 adult males, expanse, 326 (300–345); total length, 114 (104–120): 17 adult females, expanse, 334 (310–354); total length, 118 (111–125).

"Abundant everywhere, from the desert region about Fort Lowell, to the summit of the Chiricahua Mountains, 10,000 feet above sea level. A specimen taken May 30 contained several fœtuses. At Fly's Park, on the summit of the Chiricahua range, bats of this species were the first to appear after sunset. They had homes in the dense forest of firs which walled one side of the glade, and with *L. noctivigans* appeared to be the only bats that lived on the summit of the Chiricahua Mountains. At the saw mill on Rock Creek, on the west slope of the Chiricahuas, every evening these bats, singly and in companies of fours and fives, were seen flying down the cañon. At Cooley's Ranch this bat was abundant, outnumbering all the others. They appear to roost in all conceivable places, in cliffs, barns, hollow trees, tunnels and culverts."—W. W. P.

58. **Lasionycteris noctivigans** (*Leconte*). Silvery-haired Bat.—Three specimens, Chiricahua Mountains, June 11 and 23 (Price and Condit).

"Three specimens were taken and several others seen at Fly's Park, on the summit of the Chiricahua Mountains. They inhabited the forest of firs, and at nightfall came into the glade to feed."—W. W. P.

59. **Vespertilio nitidus** *H. Allen.* California Bat.—Four specimens—♀ ad., Chiricahua Mountains, June 29 (Price and Condit). Forearm, 38; 3d metacarpal, 35; total length, 100; expanse, 260. White Mountains, August 8 (W. W. Price), 2 males, measuring respectively: forearm, 37 and 37; 3d metacarpel, 32 and 33; total length, 84 and 85; expanse, 245 and 250.

"Three specimens of this species were taken; one at the saw mill on Rock Creek, in the Chiricahua Mountains, on June 29, and two at Cooley's Ranch, in the White Mountains."—W. W. P.

60. **Vespertilio melanorhinus** *Merriam.* Black-nosed Bat.—Two specimens are provisionally referred to this species, namely, an adult male taken in the White Mountains, August 2 (B. C. Condit), and a male (apparently young) taken at San Bernardino Ranch, May 4 (B. C. Condit). The White Mountain specimen is of the same golden-brown color above as the type; the other is darker, more resembling the ordinary dark phase of *V. nitidus.*

White Mts..... ♂ ad.	Forearm, 32.5	Total length, 84	Expanse, 2.40
S. B. Ranch... ♂ juv.	" 31.5	" —	" —

"Mr. Condit obtained a single specimen of this species in one of the buildings at San Bernardino Ranch on April 15, and on July 29 a second specimen under a stone in the White Mountains at an elevation of 9000 feet."—W. W. P.

61. **Vespertilio evotus** *H. Allen.* LONG-EARED BAT.—One specimen, Huachuca Mountains, ♂ ad., July 3 (L. H. Miller). Forearm, 35; 3d phal., met. I, 33; thumb, 6; total length, 85; expanse, 237; height of ear from crown (in dry skin), 14; height of tragus, 8. I also refer to this species an adult male from the White Mountains (August 8, W. W. Price), which resembles the other in size, color, and in all external features except that the tragus in each ear is defective, being square, hollowed at the top, and only about 2 mm. long. This strange condition may be due to malformation or to mutilation in life, as the two stumps are not quite symmetrical in outline, the upper border of the tragus having a different outline in the two ears.

"Mr. Miller obtained a single male from the thick branches of an oak in the Huachuca Mountains, and I collected one specimen at Cooley's Ranch on August 15, which flew into the house after dark attracted by the light."—W. W. P.

62. **Vespertilio lucifugus** *Leconte.* BLUNT-NOSED BAT.—Two specimens, from Cooley's Ranch, White Mountains, are here referred to what has usually passed current as *Vespertilio lucifugus*, of which species it seems to be a western form, the type locality of Leconte's *V. lucifugus* being South Carolina.

"A single specimen was shot at Cooley's Ranch, flying over a small pond by a house, feeding."—W. W. P.

63. **Antrozous pallidus** (*Leconte*). PALE BAT.—One specimen, ♂ ad., Cooley's Ranch, White Mountains, Aug. 15 (W. W. Price).

"A single specimen was taken at Cooley's Ranch in the White Mountains on Aug. 15. Bats supposed to be of this species were rather common flying high over the pines about the ranch buildings. They appeared early in the evening, but flew high and were difficult to secure."—W. W. P.

64. Procyon lotor hernandezii (*Wagl.*). BLACK-FOOTED RACCOON.—Two specimens, an adult male and an adult female, taken at La Noira (at head of Santa Cruz River, ten miles north of the Mexican town of Santa Cruz), Feb. 1 (Condit and Morgan), are provisionally identified as above. They represent the pale southern form of *P. lotor*. The measurements of these two specimens are as follows : Total length, ♂, 808, ♀, 815; tail vertebræ, ♂, 280, ♀, 328 ; hind foot, ♂, 120, ♀, 120; ear, ♂, 62, ♀, 55.

"Raccoons were common in willow thickets along the Rillito Creek at Fort Lowell, and about Fairbank on the San Pedro River. The tracks of a few were seen along the streams at the base of the Huachuca Mountains, and a male and female were taken from a hollow oak at the International Line just south of Huachuca Mountains. On the night previous there had been a light fall of snow, and the animals were easily tracked to the oak. I did not see any signs of them in the Chiricahua Mountains, and old settlers informed me that they were not found in the range. At Cooley's they were destructive to growing corn, pulling down the stalks, and eating the soft ears. The Apache Indians are in many places compelled to guard their fields during the corn season on account of the ravages of this pest."—W. W. P.

65. Mephitis estor *Merriam*. ARIZONA SKUNK.—Two specimens—a very old male and an old female—from Fairbank, taken respectively Feb. 27 and March 5 (Price and Condit) are referred to this species. They present extremes of variation in color, the male having the principal part of the dorsal area, including the upper surface of the tail, white, with the underfur from the shoulders posteriorly dingy gray. There is also a narrow white lateral line, and a median band of white on the ventral surface, broad over the pectoral region, narrower and somewhat interrupted posteriorly. The lower surface and apical portion of the tail is somewhat mixed with black, white prevailing. The usual frontal white stripe is reduced, however, to a narrow line.

The female is entirely black, except for a frontal stripe of white, and a white lateral line, very narrow anteriorly but widening posteriorly where it forms a broad band. The tail is black, with a small white terminal pencil, and much white at the base of the hairs, increasing in extent proximally, where many wholly white hairs are intermixed.

These specimens measure respectively: Total length, ♂, 545, ♀, 682; tail vertebræ, ♂, 268, ♀, 376; hind foot, ♂, 68, ♀, 60; ear, ♂, 34, ♀, 29. The skulls measure: Total length (front of base of incisors to posterior border of occipital condyles), ♂, 66, ♀, 61; greatest zygomatic breadth, ♂, 44, ♀, 39. In both the teeth are well worn, but more so in the male. In this specimen the tail is abnormally short.

Since the above was written three additional specimens have been received from Fort Lowell, two of them taken Jan. 9 and 16 (Price and Condit), and the other March 18 (Price and Miller). These measure as follows:

Orig. No.	Sex.	Total length.	Tail vertebræ.	Hind foot.	Ear.
382	♀	685	330	64	30
374	♂	675	355	65	28
2004	♂	630	280	72	32

The first two are without skulls; the skull of the other (No. 2004, ♂ ad.) measures 69 by 44. In this specimen the back is white with a narrow band of black posteriorly, and the tail is white at the base, along the sides, and at the tip. No. 382 (♀ ad.) has a lateral white stripe running from the ear to the base of the tail, very narrow for the anterior third of its length, with a narrow broken white line above it, at the shoulders. There is a well-developed frontal stripe, but no white on the nape or anywhere on the dorsal region between the white lateral bands. The tip of the tail has a long white pencil, and there is a tuft of white hairs on either side of the lower surface of the tail at its base. The other specimen (No. 374, ♂ ad.) has the usual frontal stripe, a broad white nape patch, continued posteriorly as far as the shoulders, and ending in a point. The rest of the body and tail are entirely black, except a few white hairs (about ten) at the tip of the tail, and a small amount of concealed white at the base of the tail hairs for the entire length of the tail.[1]

"Two specimens of this species were taken at Fairbank during February and March. The species was common at Fairbank, and often during the night carried off many small traps containing kangaroo rats and mice. Specimens were also taken at Fort Lowell and in the Catalina Mountains. It is probably distributed over the entire region."—W. W. P.

66. **Spilogale gracilis** *Merriam.* LITTLE STRIPED SKUNK.—Represented by two adult females from the Huachuca Mountains, taken Jan. 28 (Price and Condit). They measure respectively as follows: Total length, 325 and 338; tail vertebræ, 125 and 116; hind foot, 38 and 40; ear, 28 and 26.

"Two specimens were trapped in a meat house at a ranch near my camp in the Huachuca Mountains in January. I obtained evidence of the occurrence of the Little Striped Skunk at many other places, but saw no other specimens."—W. W. P.

67. **Bassariscus astutus**[2] (*Licht.*). RING-TAILED CAT.—One specimen, ♂ ad., Huachuca Mountains, Feb. 1 (Price and Condit). Measurements: Total length, 720; tail vertebræ, 345; hind foot, 68; ear, 50.

"A single male was caught in a trap at my camp in the Huachuca Mountains, Jan. 31, 1894. This species is rare in the Huachucas, though a few are killed every year by the miners and wood-choppers. They sometimes come into the houses, and when young can be tamed, and are as playful as kittens. In the Chiricahua Mountains a single specimen had been killed several years previous to my visit, the only case of its capture of which I could find evidence."—W. W. P.

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[1] For further notes on the variability of the Skunks of Arizona referred to *Mephitis estor*, see Mearns (this Bulletin, III, pp. 258-262,) and Allen (this Bulletin. VI, pp. 194-196).

[2] Mr Rhoads has recently proposed (Proc. Acad. Nat. Sci. Phila., 1893, pp. 413-418—separates dated Jan. 27, 1894) to separate "the Bassarisks of Northern Mexico and the United States" from the true *B. astutus* of southern Mexico, under the name of *Bassariscus astutus flavus*.

68. Urocyon cinereo-argenteus scottii (*Mearns*). SCOTT'S FOX.

Urocyon virginianus scottii MEARNS, Bull. Am. Mus. Nat. Hist. III, No. 2, 1891, p. 236. Pinal County, Arizona.

Two specimens, as follows: An adult female, Fairbank, March 1 (Price and Condit). Measurements: Total length, 925; tail vertebræ, 420; hind foot, 127; ear, 76. An adult male, Cooley's Ranch, White Mountains, Sept. 4 (J. Diefenbach). Measurements: Total length, 906; tail vertebræ, 363; hind foot, 121; ear, 79.

"Scott's Fox was seen over the entire region, but only two specimens were taken, one in March at Fairbank, and one at Cooley's Ranch in September by Mr. Diefenbach. They were heard howling nearly every night at my camp in the Huachuca Mountains during the summer of 1893."—W. W. P.

69. Lynx baileyi *Merriam*. PLATEAU LYNX.—Represented by two specimens: ♂ ad., Huachuca Mountains, Feb. 1 (Price and Condit); ♂ ad., Fairbank, March 12 (Price and Condit). The Huachuca specimen measures: Total length, 770; tail vertebræ, 155; hind foot, 165; ear, 80. The Fairbank specimen measures: Total length, 847; tail vertebræ, 147; hind foot, 172; ear, 86.

"Wild Cats were not uncommon over the entire country. Their tracks were seen on the summit of the Chiricahua Mountains, 10,000 feet above sea level. In the Huachuca Mountains a large male was caught in a trap in the day-time. Another was shot from a willow tree at Fairbank."—W. W. P.

70. Felis concolor *Linn.* PANTHER; MOUNTAIN LION.—One skull, ♀ ad., Huachuca Mountains, Feb. 16.

"The 'Mountain Lion' is restricted to the brushy and timbered mountains of the entire region. Occasionally this beast travels across the valleys from one range to another. One was seen on the San Pedro River above the town of Fairbank in February. It killed a colt in a pasture, and was tracked by dogs a dozen miles eastward into the Mule Mountains. In the Huachuca Mountains this animal is common. On Feb. 16, at nightfall near the summit of the range, two lions came mewing about the door of a miner's cabin. The man shot through the door, killing one, a gaunt female. The next day he threw the skinned carcass a short distance from the house. During the night the other lion came and ate nearly the whole of it; on the following evening the animal again returned, uttering a low peculiar cry. The miner wounded this one, but it escaped into the thick brush. In company with the man I trailed the beast some distance through the snow, but we finally lost the track. The man kindly gave me the skull of the female he had killed. In the Chiricahua Mountains lions are exceedingly troublesome to the raisers of colts and donkeys. In some cañons horse ranges have become nearly depopulated by the ravages of this animal. Just before my arrival in Rucker Cañon a lion killed a mare weighing over 1500 pounds. Mr. Condit found the tracks of this animal at timberline on the White Mountains."—W. W. P.

III.—LIST OF MAMMALS OBSERVED IN THE REGION, BUT OF WHICH NO SPECIMENS WERE SAVED.

By W. W. PRICE.[1]

1. COYOTE. **Canis latrans** *Say*.—Abundant over the entire region. Scarcely a night passed that bands were not heard howling, or their tracks seen in the neighborhood of our camps.

2. GRAY WOLF. [**Canis lupus nubilis** (*Say*). ? *Canis lupus mexicanus* (Linn.).]—This animal is the terror of the cattle and sheep men. A full-grown wolf is strong enough to pull down a cow, and stories are rife among the cattlemen of a band attacking and killing the strongest steer. It is found over the entire region, though more especially in the mountainous parts. We saw it on several occasions during our stay in the country.

[[1] In some instances Mr. Price, in the following list, omitted to supply scientific names, or used names recently supplanted by others; these I have supplied or changed, as the case may have required, changes from the manuscript being indicated by inclosing the names in brackets. —J. A. A.]

3. LONG-EARED FOX. [**Vulpes macrotis** *Merriam.*]—This fox is not uncommon on the San Simon Plain east of the Chiricahua Mountains, judging from the reports given me by the cattlemen. I heard of one specimen being taken at Fort Lowell previous to my arrival. I saw what I supposed to be a fox of this species early one morning while riding from the Chiricahua Mountains to San Bernardino Ranch.

[There are two Arizona specimens in the Museum Collection —one from Tucson, collected by W. E. D. Scott, and one from near Maricopa, collected by Dr. E. A. Mearns.—J. A. A.]

4. BLACK BEAR. [**Ursus americanus** *Pallas*].—Bears are found in all the mountainous and wooded regions of both Arizona and Sonora. At Rucker Cañon, in the Chiricahua Mountains, they were quite common during March and April. They had evidently left hibernation and were migrating. Bands of three or four, judging from the tracks, frequently passed through the cañon. They were common in the White Mountains during August, where several were seen in the glades digging for roots and bulbs. Mr. Condit killed one on Aug. 4.

5. SILVER-TIPPED BEAR. **Ursus horribilis** ?—This huge bear is said by the natives to inhabit all the mountains, but this needs verification. So far as I was able to learn, only one 'silver tip' had been killed in southern Arizona in recent years. The skin of this one is now in the possession of Mr. J. H. Slaughter, owner of San Bernardino Ranch, and was killed by one of his men near Guadaloupe Cañon.

6. **Sorex,** sp. ?.—A Shrew undoubtedly inhabits the fir belt of the principal mountain ranges. Dr. A. K. Fisher obtained two specimens on the summit of the Chiricahua Mountains near running water. I have seen its tracks on the Graham and the White Mountains. On one occasion I caught a tail of one in my trap.

7. WEASEL. **Putorius** —— ?.—A weasel was taken at 9000 feet elevation in the Huachuca Mountains during 1893, and from

casual observation I supposed it to be *P. brasiliensis frenatus.* The odor of weasels was noticed in both the Chiricahua and White Mountains, but no specimens were seen.

8. BADGER. [**Taxidea taxus berlandieri** (*Baird*).]—Badgers are common on the plains of the whole region. One was shot in 1893 at Fort Lowell, and is now in the collection at Stanford University. They are even found as high as Cooley's Ranch, in the White Mountains.

9. SPOTTED CAT. **Felis,** sp. ?.—A spotted cat has been seen about the Chiricahua Mountains on several occasions, and I saw a Mexican who had a saddle-bag made of a skin of one taken near Guadaloupe Cañon.

10. BEAVER. **Castor canadensis** *Kuhl.*—The Beaver is still to be found along the San Pedro and Gila Rivers. On the headwaters of the San Pedro, in Sonora, a colony of a dozen or more had their lodges up to 1893, when a trapper nearly exterminated them. All the streams in the White Mountains have beaver dams in them, although most of the animals have been trapped.

11. PALLID MUSKRAT. **Fiber zibethicus pallidus** *Mearns.*—Muskrats are found in the San Pedro River at Fairbank, and presumably at other points. A muskrat was common in Showlow Creek at Showlow, where were many trails leading from a pond up into an alfalfa field bordering it. Although we set traps for them, we did not secure any.

12. **Sciurus,** sp. ?.—A large Red Squirrel is rare in the Chiricahua Mountains, where I heard of it on several occasions through the settlers. According to them the animal is found in very diversified situations. A pair lived in 1893 in dense fir woods at the head of Rucker Canon in the southern part of the range. In Morse's Cañon, in the central part of the range, in 1892–'93, they were not uncommon at a low elevation, feeding on the cones of *Pinus edulis.* I searched diligently in both of these localities,

but no traces of them could be found. However, in dense fir woods on the summit of the range, I found gnawed cones on several occasions, but I did not see the animals. Dr. A. K. Fisher, of the Agricultural Department at Washington, who was camping near me on the summit, had the good fortune to secure a single specimen in deep fir woods on June 17. Mr. Condit saw a large red squirrel in the pines on the north slope of the Mogollon Mesa near Showlow on August 22. He is familiar with the Red Squirrel of the Eastern States, and thought it was that. It could not be captured.

13. ANTELOPE. **Antilocapra americana** *Ord.*—Antelopes are still to be found on the plains of most of the region. Several bands were found along the bases of the Huachuca and Chiricahua Mountains. The most we saw in any band was twelve—a very different story from that told by old settlers of bands of hundreds, which in the early days trampled down the grass like sheep. We also found them in the juniper belt of the north slope of the Mogollon Mesa.

14. BLACK-TAILED DEER. [**Dorcelaphus hemionus** *Raf.*[1]].—Still to be found in the foothills and ravines of the lower mountain ranges. They prefer a rather open country with oak woods. They were formerly exceedingly abundant, but, like the Antelope, will soon become practically extinct. Some few bands still live along the west slope of the Huachuca Mountains. At a ranch house we saw some very fine antlers which had been taken during the fall of 1893.

15. ELK. **Cervus canadensis** *Erxl.*—So far as we could learn this animal is now confined to a small area in the higher

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[1] [*Cervus hemionus* RAF., Am. Month. Mag., I, Oct., 1817, p. 436. Mule Deer of the Upper Missouri region.
Cervus auritus WARDEN, Descrip. statis. hist. et pol. des États-Unis de l'Amer., Sept., V, 1820, p. 640. The Mule Deer of Lewis and Clark. In the English ed., 1819, I, p. 245, and III, p. 172, it is mentioned simply as the Mule Deer.
Cervus auritus DESM., Mamm., II, 1822, p. 443. From Warden, as above.
Cervus macrotis SAY, Long's Exped., II, 1823, p. 88.

Rafinesque, on the basis of Le Raye's brief description of the Mule Deer of the Upper Missouri region, gives, under the name *Cervus hemionus*, a fair diagnosis of the Mule Deer of the early explorers of this region, to which Say in 1823 gave the name *Cervus macrotis*. There is also no question of the pertinency here of the name *Cervus auritus* given by Warden in 1820, over which, however, Rafinesque's name has three years' priority.—J. A. A.]

White Mountains. Several were seen, and a fine male was shot at about 9000 feet elevation, on August 10. They feed in the dense fir woods and glades which clothe the upper slopes of the mountains.

Mountain Sheep. [**Ovis cervina** *Desm.*[1]]—Not uncommon on the bare rocky spurs of the Santa Catalina Mountains, where they were seen during 1894. Several were killed in the fall of 1893 by an Indian hunter, and the meat sold to settlers at the foot of the mountains. Some are also said to be found on the rocky eastern flanks of the Chiricahua Mountains, but I found no positive evidence of their occurrence there. They are said to be found in the White Mountains, but none were seen there by our party.

[[1] The proper specific designation of the Big-horn or Mountain Sheep has long been in doubt. In 1817 this animal was called by Cuvier *Ovis montana*, he at the same time wrongly attributing the name to Geoffroy. Although there was a prior *Ovis montana*, given by Ord in 1815 to the Rocky Mountain Goat, this name passed current for the Big-horn till 1880, when Alston (Biol. Centr.-Am. Mam., 1880, p. 111) revived for it *Ovis cervina* Desm., giving, however, not the place and date of its first publication. Mr. Rhoads has since reverted to the subject (Reprint of Ord's Zoöl., 1894, p. 25), and, among other things, says: "Shaw (Nat. Misc., XV, t. 610) figured and described this species under the name *Ovis canadensis*, but this work, being without any date whatever, the name is unavailable, though it probably has priority over any other." Very recently Mr. C. Davies Sherborn has published in the 'Annals and Magazine of Natural History' (April, 1895, pp. 375, 376) a short paper 'On the Dates of Shaw and Nodder's "Naturalist's Miscellany,"' from which it appears (granting that the work was published at the uniform rate supposed, of which proof is lacking), that plate 610 *should* have been published in December, 1803. If there was any delay, even of but a few weeks, the part containing this plate could not have appeared till early in 1804. On the other hand, there is no question of the publication of Desmarest's name *Ovis cervina* in 1804. There can be a difference at most of but a few months in the publication of two names. Obviously the name having a positive date should have preference. (See A. O. U. Code of Nomenclature, Canon XLX, second paragraph under 'Remarks.' Biddulph (P. Z. S., 1885, pp. 682-684), in 1885, supposing *O. cervina* Desm. to date from 1818, adopted Shaw's name *canadensis*, the date of which he gives as "in or about 1804."

The history of this interesting case may be briefly presented as follows:

Belier de Montagne, E. Geoffroy, Ann. du Mus. d'Hist. Nat., II, 1803, pp. 360–363, pl. 60. Canada, lat. 50°, long. 115° = Rocky Mountains, in southern part of present Alberta, Can. (No technical name given.)

Ovis cervina Desmarest, Nouv. Dict. d'Hist. Nat., XXIV, 1804, p. 5. Based exclusively on the above, the species here first receiving a scientific name.

Ovis cervina Desmarest. Nouv. Dict. d'Hist. Nat. (nouv. éd.), XXI, 1818, p. 553. Same in substance as the last, and is the reference usually cited. Desmarest here erroneously cites "*Ovis montana* Geoffr.," and gives the plate as "pl. 40" instead of pl. 60, and omits the page reference.

"*Ovis cervina* Desmarets" Rafinesque, Am. Month. Mag., I, Oct., 1817, p. 436. Correctly attributes the name to Desmarest, but cites the date (by typographical error) as "1614" instead of 1804.

Ovis cervina Alston, Biol. Centr.-Am. Mam., 1880, p. 111 (ex Desmarest, at 1818).

"*Ovis canadensis* Shaw, Nat. Misc., XV, pl. 60" (no date: about Jan., 1804). Apparently based also on the Berlier de Montagne of Geoffroy (I am unable to verify this reference; judging from contemporary literature, Shaw's name, description and figure were doubtless based on Geoffroy, as above cited.)

Ovis canadensis Biddulph, P. Z. S., 1885, p. 683 (in text). From Shaw, as above.

Ovis montana Cuvier, Règne An., I, 1817, p. 267. Cites Geoffroy, and wrongly attributes to him the name *Ovis montana* —J. A. A.]

Article VII.—LIST OF MAMMALS COLLECTED IN THE BLACK HILLS REGION OF SOUTH DAKOTA AND IN WESTERN KANSAS BY MR. WALTER W. GRANGER, WITH FIELD NOTES BY THE COLLECTOR.

By J. A. Allen.

During the season of 1894 the Palæontological Expedition from the Museum, under the direction of Dr. J. L. Wortman, was accompanied by Mr. Walter W. Granger, an assistant in the Museum, who was sent into the field to utilize the opportunities for field work afforded by the Expedition. Mr. Granger gave most of his time to collecting the small mammals of the regions visited, but also collected many birds and reptiles. The mammals obtained number about 600 specimens, representing 42 species.

The first stop was at Pendennis, Lane County, Kansas, where three days were spent, namely, May 8–10. Here 23 small mammals were obtained, representing 7 species, one of which (*Neotoma campestris* Allen) proved to be new.

The objective point of the Expedition was the Bad Lands of the White River Miocene, on the Pine Ridge Indian Reservation, South Dakota. Here Mr. Granger collected for a month (May 16 to June 14) in the early part of summer, and again for ten days in August (Aug. 18–27). In July he left the Expedition for a trip into the Black Hills, stopping en route at a ranch on Spring Creek from June 19 to July 4; also at a ranch on the Cheyenne River from July 5 to July 13; and on Squaw Creek from July 20 to July 23. Custer, in the Black Hills, was reached July 24, where Mr. Granger remained till August 9, when he moved camp to Hill City, some twenty-five miles north of Custer, where he spent three days, returning thence to join the Expedition again in the Bad Lands. Here work was continued till August 28. About a week in the early part of September was again spent in the Black Hills, at the abandoned tin mine known as Glendale.

Later about six weeks (Sept. 14–Nov. 2) were spent at Long Island, Phillips County, Kansas, where zoölogical collecting was carried on incidentally in connection with field work in palæontology.

Although the material here under notice was gathered in part at quite distant localities, it has seemed best to combine the results of Mr. Granger's work into a single consecutive list, giving also nominal lists of the species obtained at each of the principal localities.

The following descriptive account of the localities visited is based on notes kindly furnished by Mr. Granger.

Pendennis, Lane Co., Kans.—In the prairie region of west-central Kansas. Most of the collecting was done in the 'cañons,' from ten to a hundred feet wide and thirty to forty feet in depth. A few wild currant bushes and other small shrubs grow along the bottom of these cañons. Here the following species of mammals were obtained :

Perodipus richardsoni.
Perognathus paradoxus.
Neotoma campestris.
Onychomys leucogaster.
Reithrodontomys dychei nebrascensis.
Peromyscus leucopus texanus.
Spermophilus tridecemlineatus pallidus.

Long Island, Phillips Co., Kans.—Northern border of central Kansas. The following species were obtained here :

Lepus campestris.
Lepus melanotis.
Lepus sylvaticus bachmani.
Geomys lutescens.
Mus decumanus.
Mus musculus.
Peromyscus leucopus texanus.
Sciurus niger ludovicianus.
Spermophilus tridecemlineatus pallidus.
Cynomys ludovicianus.
Scalops aquaticus argentatus.
Mephitis mesomelas.
Spilogale interrupta.

Corral Draw, Pine River Indian Reservation, South Dakota.—In the Bad Lands, between the Cheyenne and White Rivers, at the southeastern base of the Black Hills. Altitude about 3500 to 4000 feet. The country is rough and broken, consisting of alternating buttes and cañons, cut in gray clay, interbedded with occasional layers of sandstone. Some of the cañons are quite deep, their sides formed of ledges of sandstone, and with water-worn caves in the intervening beds of clay.

Corral Draw is one of the many 'draws' or valleys that lead from the interior of the bad lands down to the Cheyenne River, a distance of about ten miles. These draws are beds of creeks, which are dry except after heavy rains. The vegetation is generally scanty. A few of the higher buttes are flat-topped, and their level summits are well covered with a good growth of grass, cacti, sunflowers and other coarse plants. Sheep Mountain, the most prominent of these buttes, is covered with low cedars, which also grow in clumps on the slopes of some of the other buttes. In Corral Draw the soil is sandy and supports good grass. Cottonwoods extend about half way up the draw from the Cheyenne River.

Spring Creek, S. Dak.—Spring Creek rises in the Black Hills and runs into the South Fork of the Cheyenne River. After leaving the Hills it passes through fertile prairie lands its entire length. It is bordered by boxelder, cottonwoods, plumb thickets, willows, wild currants, and rank weeds and grass. The specimens labeled as from Spring Creek were taken at a ranch seven miles from its entrance into Cheyenne River.

Cheyenne River, S. Dak.—The specimens labeled as from Cheyenne River were taken at the mouth of Spring Creek, and hence well out from the Hills. The species obtained here were the same as those from Corral Draw, with the following in addition: *Perodipus richardsoni*, *Corynorhinus townsendi*, and *Taxidea taxus.* These doubtless also occur at the former locality.

Squaw Creek, Custer Co., S. Dak.—A small creek just in the edge of the pine forests of the Black Hills. Altitude about 3000 feet. The cañon through which the creek passes is wooded with aspens, willows, boxelders and other deciduous trees. The few mammals obtained here belong distinctively to the Black Hills fauna.

Custer, Black Hills, S. Dak.—Altitude 5500 feet. In the pine forests of the Black Hills. The collecting here was done in one of the numerous small parks near the town of Custer. This little park was about a mile and a half long by half a mile wide, and is drained by French Creek, which passes lengthwise through it. It is surrounded by pine forests. The land in the park is now mostly under cultivation.

Hill City and Glendale Mine.—These two localities are practically the same, as regards elevation and surroundings, as Custer.

The South Dakota mammals are found to fall rather sharply into two groups, those from the Bad Lands (Corral Draw, Spring Creek, and Cheyenne River) and those from the Black Hills (Custer, Hill City, Glendale, and Spring Creek). The two categories compare as follows :

Black Hills.	*Bad Lands.*
Lepus sylvaticus grangeri.	Lepus sylvaticus nuttalli,
	Lepus campestris.
Thomomys talpoides.	Thomomys talpoides.
	Perodipus richardsoni.
	Perognathus paradoxus.
	Perognathus fasciatus.
	Erethizon epizanthus.
Zapus princeps.	
Neotoma grangeri.	Neotoma rupicola.
Peromyscus leucopus arcticus.	Peromyscus l. nebrascensis.
Microtus longicaudus.	
Microtus insperatus.	Microtus haydeni.
Evotomys gapperi brevicaudus.	
Fiber zibethicus pallidus.	
Arctomys dacota.	
	Cynomys ludovicianus.
Spermophilus tridecemlineatus pallidus.	Spermophilus t. pallidus.
Tamias quadrivittatus borealis.	Tamias minimus.
Sciurus hudsonicus dakotensis.	
	Adelonycteris fusca.
	Vespertilio ciliolabrum.
	Corynorhinus townsendi.
Sorex forsteri.	
Putorius longicaudus.	
	Taxidea taxus.

The above lists are of course not exhaustive for the localities treated, and more of the species are common to the two regions than these comparative lists indicate. It is interesting to note that there are several representative or parallel forms, according in coloration and in other features with their respective surroundings, as strikingly illustrated in the genera *Lepus*, *Peromyscus*, *Neotoma*, and *Tamias*.

A few species are included of which no specimens were obtained, these being given on the authority of Mr. Granger. They are mainly the larger game and fur-bearing animals of the Black Hills region, respecting which Mr. Granger gives interesting information.[1]

The collection contained a number of forms believed to be new, and as such were mostly described in the preceding volume of this Bulletin (Vol. VI, pp. 320, 322–326, 346). They are as follows:

Lepus sylvaticus grangeri.[2]
Neotoma campestris.
Neotoma grangeri.
Neotoma rupicola.
Microtus insperatus.
Sciurus hudsonicus dakotensis.

1. **Cervus canadensis** *Erxl.* Elk.—"The Elk has been extinct in the Black Hills for several years, but the numerous antlers which are to be seen at nearly every ranch show that it was recently not uncommon."—W. W. G.

2. **Dorcelaphus hemionus** (*Raf.*). Mule Deer; Black-tailed Deer.—"Numerous in the Black Hills. About extinct in the Bad Lands."—W. W. G.

3. **Dorcelaphus virginianus macrourus** (*Raf.*).[3] White-tailed Deer.—"Two White-tailed Deer came to an oat field near camp one morning at Custer. They were the only ones I saw."—W. W. G.

4. **Antilocapra americana** *Ord.* Antelope.—"Becoming very scarce south of the Belle Fourche River, and entirely exterminated in the vicinity of Spring Creek."—W. W. G.

5. **Ovis cervina** *Desm.* Mountain Sheep.—"I was told of the presence of a small herd of Mountain Sheep in the vicinity of Harney Peak, in the Black Hills. In the Bad Lands they are quite common. Several were seen by our party, and their

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[1] Mr. Granger's field notes are distinguished by marks of quotation and his initials (W. W. G.).

[2] Described below, p. 264.

[3] *Cervus macrourus* Rafinesque, Am. Month. Mag., I, Oct., 1817, p. 436. Based on the "long-tailed deer" of Charles Le Raye's Journal. *Cf.* Baird (Mam. N. Am., 1857, p. 652) on the probable availability of the name *Cervus macrourus* Raf. for the White-tailed Deer of the Upper Missouri and Upper Platte region, as against *C. leucurus* Douglas based on a deer from the Columbia River.

tracks could be seen at any time. They live mostly in the high flat-topped buttes, where there is good grass."—W. W. G.

6. **Lepus campestris** *Bach.* PRAIRIE HARE; WHITE-TAILED JACK RABBIT.—Corral Draw, May 25, 2 specimens; Long Island, Kans., Sept. 24 and Oct. 27, 2 specimens.

7. **Lepus melanotis** *Mearns.* EASTERN BLACK-EARED JACK RABBIT.—Long Island, Kans., Sept. 17–Nov. 2, 8 specimens.

8. **Lepus sylvaticus bachmani** (*Waterh.*). TEXAN WOOD HARE.—Long Island, Kans., Sept. 15–Oct. 29, 10 specimens.

In general features these specimens greatly resemble the form of Wood Hare of the coast region of Texas. They are, however, somewhat larger, but not otherwise sensibly different.

Five adult females and three adult males measure as follows: Total length, 399 (372–432); tail vertebræ, 55 (51–63.5); hind foot, 93 (89–95).

9. **Lepus sylvaticus nuttalli** *Bach.* NUTTALL'S WOOD HARE.—Corral Draw, May 23 and Aug. 22–26, 7 specimens; Battle Creek, May 28, 1 specimen; Cheyenne River, July 7–12, 6 specimens.

Of these 14 specimens 8 are young in various stages of immaturity. They are provisionally referred to the northern interior form of the *sylvaticus* group, specimens from the type locality of *nuttalli* (Columbia River region) being unavailable for comparison.

10. Lepus sylvaticus grangeri, subsp. nov.

BLACK HILLS WOOD HARE.

A series of 6 specimens from Hill City, in the Black Hills (Aug. 10, 11), represent a form of the *sylvaticus* group very different from that found in the bad lands and creek bottoms of the adjoining country to the eastward, the differences being shown quite as strikingly by the half-grown young of the two forms as by the adults.

Size medium; ears small and heavily clothed, as are also the feet; coloration dark. Dorsal region dull vinaceous buff, minutely varied with black and gray, becoming purer gray posteriorly, and dull yellowish gray on the sides. Inner edge of thighs buffy; rest of lower parts pure white, with the usual pectoral collar of grayish brown. Ears small, externally dusky varied with gray, well clothed on both surfaces.

Measurements.—Total length (average of two adults), 353; tail vertebræ, 53; hind foot, 90; ear (from notch), 60.

Type, No. $\frac{9094}{7402}$, ♂ ad., Hill City, Custer Co., S. Dak., Aug. 11, 1894; W. W. Granger.

Young in first pelage resemble the adults in coloration, except that the tints are duller.

This is a mountain form, comparable with *L. s. pinetis* of the White Mountains of Arizona (see this Bulletin, VI, 1894, p. 348), which form it strongly recalls in its dark coloration and small hairy ears. Its coloration is in strong contrast with that of the form inhabiting the adjoining open country to the eastward, the pale yellowish tints of the latter being replaced in the mountain form by pale vinaceous.

11. **Erethizon epizanthus** *Brandt.* YELLOW-HAIRED PORCUPINE.—"Not uncommon along the Cheyenne, and in the Bad Lands."—W. W. G.

12. **Geomys lutescens** *Merriam.* LUTESCENT POCKET GOPHER.—Long Island, Phillips Co., Kans., Sept. 16–Oct. 13, 5 specimens.

13. **Thomomys talpoides** (*Rich.*). GRAY POCKET GOPHER.—Corral Draw, May 23–June 14, 4 specimens; Spring Creek, July 5, 1 specimen; Custer, July 27, 1 specimen. As shown by the above list of localities, this species is found not only in the prairie country at the base of the Black Hills, but in the small parks in the Black Hills, at an altitude of 5500 feet.

14. **Perodipus richardsoni** *Allen.* RICHARDSON'S KANGAROO RAT.—Pendennis, Lane Co., Kans., May 8, 1 specimen (♀ ad.); Cheyenne River, Custer Co., S. Dak., July 7–10, 3 specimens (1 ♂ ad. and 2 ♀♀ im.).

15. Perognathus paradoxus *Merriam.* LARGE POCKET MOUSE.—Pendennis, Kans., May 8, 1 specimen (♂ ad.); Corral Draw, Aug. 23–25, 8 specimens, including three quarter-grown young; Corral Draw, Aug. 27, 1 specimen (a nursling).

The young in first pelage differ greatly in coloration from the adults, the whole dorsal surface being drab-gray, with no trace of a fulvous lateral line. At the next stage, or when about one-fourth grown, they are fuliginous brown above, varied with fulvous-tipped hairs, with, however, the fulvous lateral line well developed, but in general coloration still very unlike the adults.

16. Perognathus fasciatus *Wied.* MAXIMILIAN'S POCKET MOUSE.—Cheyenne River, July 7, 1 specimen (♂ im.); Corral Draw, Aug. 20–27, 5 specimens (♂ and ♀ ad., and three young about one-third grown).

Very young specimens show only a faint trace of the pale yellow lateral line, and they are grayer above with less olive than adults.

17. Zapus princeps *Allen.* ROCKY MOUNTAIN JUMPING MOUSE.—Two specimens (one a skull only without skin), collected Aug. 6 at Corral Draw, are provisionally referred to this species. While closely agreeing with this species in coloration and in cranial characters, it differs from it in the possession of much larger ears, in this respect resembling *Z. trinotatus* Rhoads.

18. Fiber zibethicus pallidus *Mearns.* PALE MUSKRAT.—Custer, Aug. 4–9, 7 specimens; Hill City, Aug. 10, 2 specimens. These examples seem quite as pale and as small as typical specimens of *pallidus* from Arizona. Unfortunately, however, measurements taken from the fresh specimens are lacking.

"Common on nearly all of the creeks which have their origin in the Black Hills."—W. W. G.

19. Microtus (Mynomes) longicaudus (*Merriam*).—LONG-TAILED MEADOW MOUSE.

Arvicola (Myonomes) longicaudus MERRIAM, Am. Nat. Oct. 1888, p. 935. Custer, S. Dakota.

Three adult specimens, collected at Custer (the type locality of the species), July 25–Aug. 9.

20. Microtus (Mynomes) insperatus *Allen.* BLACK HILLS MEADOW MOUSE.

Arvicola insperatus ALLEN, Bull. Am. Mus. Nat. Hist. VI, 1894, p. 347.

Four specimens, Custer, July 25–Aug. 9, and one specimen, Hill City, Aug. 11, as already noted (*cf.* this Bulletin, l. c.).

This may be a form of *M. pennsylvanicus* (=*riparius* auct.), but it is much paler and grayer than specimens from the Atlantic Coast region, the difference in coloration being striking.

"I found these mice in the same localities as the other species [*M. longicaudus*]. Some were caught on a hillside which was covered with aspens, and the rest along the banks of a creek."—W. W. G.

21. Microtus (Pedomys) haydenii (*Baird*). HAYDEN'S MEADOW MOUSE.—One specimen, Spring Creek, June 22. (*Cf.* this Bulletin, VI, 1894, pp. 328–330.)

22. Evotomys gapperi brevicaudus *Merriam.* BLACK HILLS RED-BACKED MOUSE.—Custer (type locality of the species), July 25–Aug. 9, 19 specimens; Hill City, Aug. 10, 1 specimen. Eight specimens of the 20 are more or less immature. The 12 adults give the following measurements: 7 males, total length, 131 (120.6–146); tail vertebræ, 36 (33–39); hind foot, 19.5 (19–20.5): 5 females, total length, 140 (130–146); tail vertebræ, 37 (35–39.6); hind foot, 19.8 (19–20.5). The females thus average slightly larger than the males.

Compared with *E. gapperi* from New Brunswick, the red of the dorsal region is darker and the sides are much grayer, with almost none of the strong yellowish tint seen in *E. gapperi*. It is also somewhat smaller, 20 adults of *E. gapperi* (10 ♂♂ and 10 ♀♀) from Trousers Lake, N. B., measuring as follows: Total length, 141 (130–162); tail vertebræ, 40 (35–45); hind foot, 19.3. The corresponding averages for the 12 Black Hills specimens are 134, 36.7, and 19.6. The ears in *brevicaudus*, as stated by Dr. Merriam, are conspicuously larger than in *gapperi*.

23. **Onychomys leucogaster** (*Wied*). MISSOURI GRASSHOPPER MOUSE.—Represented by 6 specimens, all adult, collected at Pendennis, Lane Co., Kans., May 8–10.

24. **Peromyscus leucopus arcticus** (*Mearns*). ARCTIC WHITE-FOOTED MOUSE.—The Black Hills form of *Peromyscus leucopus* seems distinctly referable to *arcticus*. As a series the Black Hills specimens tend to a slight fulvous wash, but a large part of them fairly match a small series from Osler, Saskatchewan, received in exchange from Mr. Outram Bangs, two of which are labeled by Mr. Bangs as "almost perfect matches of the type [of *arcticus*, from Fort Simpson, H. B. T.] in color, length of tail, etc."

I refer to this form two series, one of 39 specimens, collected at Custer (alt. 5500 feet), July 25–Aug. 9, and another of 20 specimens, collected on Squaw Creek, "just in the edge of the pine forests of the Black Hills," July 20–22. The Custer series is uniformly dark, only a few specimens presenting any decided fulvous or reddish wash. The Squaw Creek series is similar in coloration, except that it contains one specimen (No. 9370) strongly approaching the characteristic fulvous tint of *nebrascensis*, to which form it should perhaps be referred.

Nineteen specimens from Custer give the following measurements: 10 males, total length, 149 (140–165); tail vertebræ, 65 (57–76); hind foot, 20.3 (19–22): 9 females, total length, 143 (128.5–162); tail vertebræ, 61 (50–73); hind foot, 19.3 (17.5–20–5).

25. **Peromyscus leucopus nebrascensis** (*Mearns*[1]). FULVOUS WHITE-FOOTED MOUSE.—Many of the specimens here referred to *nebrascensis* agree perfectly with the series on which *nebrascensis* Mearns was based (all October specimens, from the

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[1] Baird (Mam. N. Am., 1857, p. 462, in text, lines 5 and 6) makes the following reference to a var. *nebrascensis*: "Judging from the color and the extreme shortness of tail, I am inclined to believe that Richardson's species [*Mus leucopus*] is the *Hesperomys sonoriensis*, var. *nebrascensis*." He gave no description or diagnosis, and nowhere else employed the name, which was thus a *nomen nudum*, till defined and duly installed by Mearns in 1890 (this Bulletin, II, No. 4, Feb, 1890, p. 287). Apparently he intended at one time to adopt this name for the Upper Missouri specimens, but later decided to refer them to *sonoriensis*, and finally based, as he states (l. c., p. 474), his description of his *Hesperomys sonoriensis* on specimens "from the Upper Missouri"—in other words, the Plains region from South Dakota north to northern Montana, as shown by his table of specimens. The basis of Mearns's *nebrascensis* is a series of seven specimens from the northwestern part of Custer Co., Montana, belonging to this Museum.

plains north of the Yellowstone), but the midsummer adults are bright golden brown above, and hence much more strongly fulvous than fall specimens of *nebrascensis*. The midsummer adults of the Granger collection are, however, paler, or yellower, than true *texanus*.

The Granger specimens referred to this form are (1) a series of 16 collected on Spring Creek, at the edge of the Bad Lands, June 19–23; (2) a series of 6 collected on Cheyenne River, bordering the Bad Lands, July 7–12; (3) a series of 34, collected at Corral Draw, in the Bad Lands, May 16–June 6; (4) a series of 11 collected at the same locality, August 19–27.

The adult August specimens agree well with the type series of *nebrascensis;* the May, June and July adults are many of them much brighter and more golden, while many others are not distinguishable from fall specimens of the type series. Doubtless the lighter and more yellowish coloration of the May and June and early July specimens is a seasonal feature.

Thirty adult specimens from Corral Draw give the following measurements: 15 males, total length, 157.5 (144–165); tail vertebræ, 66 (59–71); hind foot, 19.5 (17.5–20.5): 15 females, total length, 156.5 (144.5–173); tail vertebræ, 65 (60–76); hind foot, 19.3 (17.5–20.5). There is thus practically no sexual difference in size.

The difference in color between the series from the arid Bad Lands (*nebrascensis*) and the Black Hills series (*arcticus*) is remarkably striking, affording an excellent illustration of the influence of environment.

26. Peromyscus leucopus texanus (*Waterhouse*). TEXAN WHITE-FOOTED MOUSE.—Two specimens from Pendennis, Lane Co., Kans. (May 8–10), and one from Long Island, Phillips Co., Kans. (Oct. 6), are provisionally referred to this subspecies.

27. Neotoma campestris *Allen.* PLAINS WOOD RAT.—Pendennis, Kans., May 8; 10 specimens, as already recorded (this Bulletin, VI, 1894, p. 322).

"The ten specimens obtained were all taken in a single cañon. The rocky sides of the cañon afforded excellent retreats for the rats. They build large bulky nests, under shelving rocks, consisting of several bushels of prickly pear (cacti), 'cow chips,' sticks, and weeds. The animals were very unsuspicious and easily trapped."—W. W. G.

28. Neotoma rupicola *Allen.* BAD LANDS RAT.—Corral Draw, June 7 and Aug. 20–27; 35 specimens, as already recorded (this Bulletin, VI, pp. 323, 324).

"This was a common species in the Bad Lands, where it lives in small caves and crevices along the 'draws' and cañons, and in hollow cottonwoods at the bottom of the draws. It builds small nests of cacti. It is occasionally found at the ranches along the Cheyenne River."—W. W. G.

29. Neotoma grangeri *Allen.* BLACK HILLS WOOD RAT.—Custer, July 25–Aug. 9, 14 specimens; Glendale, Sept. 8, 2 specimens. (For previous record see this Bulletin, VI, pp. 324, 325.)

"Inhabits the ranches and log cabins. Nearly every deserted log cabin contained a brood of them at the time of my first visit to the Black Hills (July 24 to Aug. 11). At Glendale Mine I trapped two or three in the mill, where they had done much damage by destroying the leather lacings of the belting. A small nest is sometimes built, which is very different from that made by *N. campestris.*"—W. W. G.

30. Mus decumanus *Pall.* BROWN RAT.—Long Island, Kans., Sept. 14–16, 11 specimens.

31. Mus musculus *Linn.* HOUSE MOUSE.—Spring Creek, 2 specimens; Squaw Creek, 1 specimen; Glendale, 1 specimen; Long Island, Kans., 2 specimens.

32. Sciurus niger ludovicianus (*Custis*). WESTERN FOX SQUIRREL.—Long Island, Kans., Oct. 7–16, 4 specimens. They are all small (probably young of the year), with the ventral surface wholly white, or white slightly blotched or washed with pale fulvous. They are not apparently otherwise different from average Illinois specimens, which are also often white-bellied.

33. **Sciurus hudsonicus dakotensis** *Allen.* BLACK HILLS CHICKAREE.—Squaw Creek, July 21–23, 3 specimens; Glendale, Sept. 3–5, 7 specimens, as already recorded (this Bulletin, VI, pp. 325, 326).

"A common animal throughout the timber. Similar in habits to the Eastern Chickaree, from which it differs, however, slightly in its notes."—W. W. G.

34. **Tamias minimus** *Bach.* PALE CHIPMUNK.—Corral Draw, May 16–June 7, 7 specimens; same locality, Aug. 21–27, 8 specimens. The May specimens are faded, but are not yet in molt; the June specimens are much worn and were molting; the August specimens have nearly all acquired the new dress, and are much more strongly colored than the May and June specimens.

35. **Tamias quadrivittatus borealis** *Allen.* NORTHERN CHIPMUNK.—Squaw Creek, July 24, 1 specimen; Custer, Aug. 4, 4 specimens; Glendale, Sept. 4, 5, 13 specimens. The series is quite uniform in coloration, all of the specimens being in post-breeding dress. They are of course all from the wooded region of the Black Hills, and in coloration are in striking contrast with the series of *T. minimus* from the adjoining Bad Lands.

36. **Spermophilus[1] tridecemlineatus pallidus** *Allen.* PALE STRIPED SPERMOPHILE.—Pendennis, Kans., May 8, 1 specimen; Long Island, Kans., Sept. 15–18, 3 specimens; Spring Creek, S. Dak., July 4, 1 specimen; Custer, S. Dak., July 24–29, 19 specimens.

37. **Cynomys ludovicianus** (*Ord*). MISSOURI PRAIRIE DOG.—Corral Draw, June 25, 4 specimens; Cheyenne River, July 13, 3 specimens; Long Island, Kans., Sept. 15, 1 specimen.

The June specimens are still in the soft coat of winter, and in three of them the coarse over-hair has either been cast or has worn off so that very little of it remains, leaving the general coloration yellowish instead of reddish. The July specimens have nearly completed the spring molt, though one of them still retains the winter coat over the posterior fifth of the body, showing that the coat is renewed in spring from the head posteriorly. The September (Kansas) specimen is also in mixed coat, the summer pelage still clothing the top of the head, nape and shoulders, while the rest of the dorsal surface is clothed with the new winter coat, showing that the fall molt begins at the posterior part of the body and proceeds gradually towards the head.

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[1] In this volume of the Bulletin (*antea*, p. 337) I hastily followed Dr. Merriam in substituting *Anisonyx* for *Spermophilus*. While *Anisonyx* Rafinesque is pertinent and antedates *Spermophilus*, it is preoccupied by use ten years earlier by Latreille (Gen. Crust. et Insect, II, 1807, p. 119) for a genus of Coleoptera—a fact that might easily have been discovered by reference to the 'Nomenclator Zoologicus' of either Agassiz or Scudder Dr. Merriam has recently corrected the unfortunate error (Science, N. Ser., II, No. 30, p. 107, July 26, 1895).

38. Arctomys dacota *Merriam.* BLACK HILLS MARMOT.—Four specimens, three adult and one half grown, Custer, July 26–29. These specimens are from the type locality of the species; they are very uniform in coloration, and agree so well with the original description as to leave nothing to be added, except to make record of the measurements for future reference.

9138 ♀ ad.	Total length,	622;	tail vertebræ,	179;	hind foot,	84.
9139 ♂ ad.	"	635;	"	179;	"	84.
9140 ♂ ad.	"	622;	"	178;	"	84.
9141 ♀ juv.	"	457;	"	152;	"	78.

"I found the Woodchucks at an altitude of about 5000 feet in the Hills, where they were fairly common, and confined almost entirely to the rocky cliffs."—W. W. G.

39. Castor canadensis *Kuhl.* BEAVER.—No specimens were taken, but Mr. Granger contributes the following note: "Rapidly becoming exterminated. There is a small colony near the mouth of Spring Creek, and two trappers took ten from Battle Creek in the winter of 1893–94."—W. W. G.

40. Corynorhinus townsendii (*Cooper*). TOWNSEND'S BAT.—Three specimens, Cheyenne River, July 8–12. Alar expanse, 308 (305–310); total length, 104; tail vertebræ, 46; hind foot, 9.4.

This seems to be a rare bat in collections. It was originally described from "Columbia River" specimens, and was recorded by Dr. H. Allen (Mon. N. Am. Bats, p. 66) in 1864 from "Utah," and "Upper Missouri," the latter record being based on a single specimen collected by Dr. F. V. Hayden. In his later Monograph

(1894, p. 60) he records only these same examples. Dobson, in 1878 (Cat. Chirop., p. 181) records a single specimen from Vancouver Island. In this Museum there are three specimens from Arizona (Fort Verde, Mearns; Pinal Co., Scott; and Prescott, Keays) and one from Guadalajara, Mexico (Buller), which I provisionally refer to this species.

41. **Adelonycteris fusca** (*Beauvois*). BROWN BAT.—Three specimens from Corral Draw and one from Squaw Creek are very much paler than any examples of this species I have seen from other localities. They seem to indicate the existence of a pale race of this species in this region of pallid forms.

42. **Vespertilio ciliolabrum** *Merriam*. LITTLE PALE BAT.—This small, pale bat is represented by 7 specimens, 6 of which are males, taken at Corral Draw, in the Bad Lands, May 16 to June 4, and one (the female) Aug. 19. The following are the average and extremes of the measurements recorded by the collector on the labels: Total length, 82 (79.5–85.5); tail vertebræ, 38 (36–39.6); hind foot, 7.9; alar expanse, 214 (201–223). This series is very uniform in coloration, the color of the upper parts being pale buffy white.

43. **Scalops aquaticus argentatus** (*Aud. & Bach.*). SILVERY MOLE.—Long Island, Kans., Oct. 6–19, 3 specimens. These are much lighter and more 'silvery' than Mississippi Valley specimens.

44. **Sorex forsteri** *Rich.* FORSTER'S SHREW.—The single specimen of Shrew, taken at Custer, July 25, has been kindly identified by Mr. Gerrit H. Miller, Jr., as above. The collector's measurements are: Total length, 87; tail vertebræ, 36; hind foot, 11. Sex, ♀ ad.

45. **Putorius longicauda** *Bon.* LONG-TAILED WEASEL.—Custer, July 29, ♂ ad. Total length, 366; tail vertebræ, 132; hind foot, 40. Hill City, Aug. 10, ♂ ad. Total length, 386; tail vertebræ, 135; hind foot, 40. There is an additional skull, without skin, from Custer.

46. Lutreola vison (*Schreb.*). MINK.—Long Island, Kans., Oct. 10, ♂ ad. Total length, 625 ; tail vertebræ, 200 ; hind foot, 66.

47. Spilogale interrupta (*Raf.*). BLACK-TAILED STRIPED SKUNK.—Long Island, Kans., Oct. 10–30, 3 specimens.

9130 ♀ ad.	Total length, 546 ;	tail vertebræ, 208 ;	hind foot, 51.
9131 ♂ juv.	" 484 ;	" 181 ;	" 51.
9132 ♂ juv.	" 433 ;	" 184 ;	" 43.

48. Mephitis mesomelas *Licht.* TEXAS SKUNK.—Custer, Aug. 8, ♂ ad., skin and skull and an additional skull ; Long Island, Kans., Oct. 10–13, 3 specimens.

These specimens are all referred to this form, to which Kansas specimens seem undoubtedly to belong. The single Black Hills skin is immature, but seems to be best referred here.

49. Taxidea taxus *Schreb.* BADGER. — Cheyenne River, July 13, ♀ juv.

50. Canis lupus nubilus (*Say*). GRAY WOLF.—" Not uncommon at all the localities visited. Along Cheyenne River a good many cattle and colts are annually destroyed by them. I saw three Wolves kill a calf in Corral Draw one evening."—W. W. G.

51. Canis latrans *Say.* COYOTE.—" More common than the Wolves."—W. W. G.

52. Vulpes (? macrourus *Baird*). " There was a den of Red Foxes in one of the draws in the Bad Lands, but I was unable to obtain any of them."—W. W. G.

53. Lynx (sp.—— ?). — " Several Lynxes have been killed along Spring Creek during the last two years. They also exist in the Bad Lands and in the Black Hills in some numbers."—W. W. G.

Probably *L. rufus* and *L. canadensis* are both found in the region under consideration.

Article VIII.—DESCRIPTIVE CATALOGUE OF THE SPHINGIDÆ FOUND WITHIN FIFTY MILES OF NEW YORK CITY.

By William Beutenmüller.

Plates II–VII.

The present paper constitutes the second part of my work on the Lepidoptera found within a radius of fifty miles of New York City, and is the beginning of a series of similar papers on the Moths of the region. The first part of the work, on the Butterflies, was published in the Museum Bulletin, Volume V, 1893, pp. 241–310.

The main object of the work is to enable those interested in the study of our local fauna to identify their material. The descriptions in the following pages have been made as brief and simple as possible, and with the aid of the illustrations the species may be readily recognized.

Family SPHINGIDÆ.

The members of this family are commonly called Hawk-moths, on account of their powerful and rapid flight; they are also called Hummingbird Moths, owing to their peculiar habit of hovering over flowers while drawing up nectar with their long proboscis, and while in this position they superficially resemble Hummingbirds. Some species fly during mid-day in the hottest sunshine, while others fly late in the afternoon and at night.

The moths are of medium or large size, with long and narrow fore wings, with an oblique and entire outer margin or with the outer margin excavated or scolloped. The hind wings are much shorter with the outer margin entire, the anal angle usually produced and the apex rounded or pointed.

The head is usually clothed with smooth scales, or has a tuft between the antennæ.

The eyes are hemispherical, naked, and are as a rule lashed in front above.

The proboscis is well developed in most of the species, and is nearly as long or longer than the body, and when not in use is curled up like a watch-spring between the palpi. The antennæ are fusiform, ciliate in the male and simple in the female, and with the tip more or less bent into a hook. In some species the antennæ are club-shaped, with a few short setæ at the extreme tip.

The thorax is well developed, either with the vestiture smooth, or with the posterior portion with erect scales, or with the anterior portion with an elevated tuft.

The abdomen is long and graceful as a rule, with the segments gradually tapering, and some species are provided with a more or less complete fan-like tuft at the end of the body.

The mature larvæ are smooth, or sometimes more or less granulated over the surface. The last segment is provided with a horn, or, in absence of this, the place is marked by a tubercle or polished eye-like spot instead. The majority of the larvæ are provided with seven lateral oblique stripes. After they have reached maturity and are ready to transform they descend to the ground and burrow into the soil, where they construct a cell, in which they change to pupæ. Some species, however, form their pupæ on the surface of the ground, in a loose cocoon between leaves. The pupæ are most always chestnut brown, elongate, with the tongue-case buried or detached and resembling the handle of a pitcher.

Subfamily MACROGLOSSINÆ.

Hemaris *Dalman.*

Head small, untufted; palpi closely scaled, cone-like; proboscis corneous, nearly as long as the body; eyes of medium size, lashed; antennæ about two-thirds as long as the costa of the fore wings, swollen, club-shaped towards the end, which terminates in a minute and bent seta, biciliate in the males, simple in the females; thorax smooth, closely scaled; abdomen flattened beneath, with a broad fan-like anal tuft. Fore wings eleven-veined, transparent in the middle, the outer border somewhat rounded; hind wings also transparent in the middle, the outer border somewhat excavated between veins 1*b* and 2.

The members of this genus fly during the middle of the day in the hot sunshine. They hover over flowers and very much resemble Hummingbirds. The larvæ construct loose cocoons on the surface of the ground.

Hemaris thysbe (*Fabr.*).

Plate II, Fig. 1.

Fore wings transparent, with narrow costal and inner borders, broad outer border dentate within, and base reddish brown; the extreme base is washed with olive green scales. Hind wings also transparent, with a narrow outer border and basal half of wings reddish brown, costal border very narrow; borders of wings beneath paler than above. Head and thorax above olive green, white beneath. Abdomen above with first and second segments yellowish green, third and fourth reddish brown, and fifth and sixth olive green and reddish brown along the middle; abdomen beneath reddish brown with small white tufts at the sides; anal tuft reddish brown, black at the sides. Legs whitish, with the tarsi reddish brown. Expanse of wings about 2 inches=50 mm.

Var. **uniformis** *Gr. & Rob.*—(Plate II, Fig. 2.) Differs from *thysbe* in having the outer border of the fore wings somewhat narrower and not dentate within. It is also less common. Size same as *thysbe.*

Var. **floridensis** *Gr. & Rob.*—Similar to *thysbe* but is more robust and larger, with the borders of all the wings broader, thus making the vitreous space smaller. Expanse, 2.40 inches=65 mm.

Larva.—Head pale green, with numerous minute granulations. Body pale whitish green along the dorsal region, limited by a serrated white longitudinal line along the subdorsum and running from the anterior edge of the second segment to the caudal horn; these two lines are in close proximity on the second segment, but gradually become wider apart on the middle segment, and the space between decreases again as they meet at the sides of the caudal horn; along the dorsum are two longitudinal white stripes close together; sides of body light green; spiracles yellow, scarlet red in the middle; first segment with granulations on the dorsum (representing the cervical shield); anterior edge of second segment with a transverse row of canary yellow elevated spots; caudal horn blue, with black and white dots; over the body are numerous small white dots placed regularly in transverse rows. Underside deeper green than above, sometimes partly pink; thoracic feet reddish with a black and yellow ring, extreme base yellow; abdominal legs green with a black and yellow patch outside, the yellow forming a stripe on the tenth and eleventh segments. Anal plates edged with yellow. Length, 1.60–2 inches=40–50 mm.

Pupa.—Broadest about the middle, tapering thence to the anal extremity; surface finely shagreened; color brownish black; junction of segments smooth, brown; head-case subtriangularly produced; tongue-case buried; terminal spine broad at base, somewhat flattened, rugose, rounded towards the tip, with a marginal row of minute hooks on each side, and a larger double hook at the tip. Length, 1 inch=25 mm.

Food-plants.—Various species of *Viburnum*, Honeysuckle and Snowberry (*Symphoricarpos*).

Very common in this vicinity, especially during the latter part of July and early in August. It is double brooded, the first brood appearing during the latter part of May and early in June. The eggs are generally deposited singly on the underside of leaves. The larva when fully grown spins a thin web-like cocoon among leaves on the ground. The form *uniformis* is less common than *thysbe*, and the form *floridensis* is very rare in this district, but is common southward. The species ranges from Labrador and Canada to Florida and westward to the Mississippi.

Hemaris gracilis (*Gr. & Rob.*).

PLATE II, FIG. 3.

Wings transparent, with reddish brown borders, outer border broad with the inner margin straight. Thorax and first and second segments of the abdomen olive green, remaining segments reddish brown, slightly olive at the sides of the last two segments ; anal tuft reddish brown with a black tuft at each side. Thorax beneath pale yellowish white with a reddish brown stripe on each side. Abdomen beneath reddish brown with three rows of small white scale-like spots. Legs reddish brown. Expanse, 1.60 inches=40 mm.

Very rare in this neighborhood, appearing in May and June and again in July and August. It is closely allied in general appearance to *H. thysbe* var. *uniformis*, but differs from it by its smaller size and by having a red stripe on each side of the thorax beneath and three rows of white spots on the underside of the abdomen. It is also a more graceful and slender built insect than *uniformis*. The early stages are unknown.

Hemaris diffinis (*Boisd.*).

PLATE II, FIG. 4.

Fore wings largely transparent, with a very narrow blackish costal border and a broader outer border of the same color, gradually narrowing as it reaches the hind angle ; at the apex on the outer border is a rust colored spot ; base of wings with a blackish patch elongated along inner margin. Hind wings also transparent with a very narrow outer border and a very broad inner border marked with red. Head above and thorax along the middle olive yellow, sides of thorax yellow ; the colors of the thorax are continued over the back of the basal segments of the abdomen which is black, last two segments yellowish ; anal tuft black, yellow in the middle above. Thorax beneath yellow. Legs black. Upper side of palpi black, underside yellow. Expanse of wings, 1.60 inches=40 mm.

Larva.—Head oval, green, bluish, or reddish, with fine granulations. Body bluish above, green at sides and reddish beneath, sometimes more entirely reddish or brownish. Along the back is a median reddish shade and a whitish or yellowish subdorsal line along each side running from the second segment to the caudal horn ; laterally above the spiracles is a yellow line more or less broken ; caudal horn black or reddish ; the granulations of the cervical shield anteriorly are yellow. Length, 1.50–1.60 inches=37–40 mm.

Pupa.—Similar to that of *H. thysbe ;* in fact there is no perceptible difference between them.

Food-plants.—Bush Honeysuckle, Snowberry (*Symphoricarpos*), and Feverwort (*Triosteum perfoliatum*).

Found during the latter part of May and early in June, and again during July and probably August. In the immediate vicinity of New York this species is very rare. It is found from Canada to Florida and westward to Missouri and Iowa, and in certain localities is rather common.

Hemaris axillaris (*Gr. & Rob.*).

Fore wings transparent with dark brown borders, the outer one broadest and dentate within, and with a dark reddish mark before the apex. Hind wings also transparent and bordered with dark brown. Head, thorax and first two segments above, olive yellow or greenish. Abdomen black, brownish on the back, the last two segments olive yellow ; anal tuft black, olive yellow centrally above. Underside of head and thorax light yellow, the latter with a black stripe on each side. Legs black. Expanse, 1.60–1.80 inches=40–45 mm.

Var. **marginalis** *Gr.*—Color and size same as in *H. axillaris*, but differs in having the outer border even or slightly dentate within instead of strongly dentate.

Larva.—Whitish green on the dorsum, yellowish green on the sides, and dark brown on the underside. Head yellowish green, mandibles black. Cervical shield with yellow tubercles on each side. Spiracles black surrounded by a narrow white border. Caudal horn glossy black, yellow at the base. Thoracic feet black. Length, 1.25–1.50 inches=31–37 mm.

Pupa.—Similar to that of *H. thysbe.*

Food-plants.—Various species of plants of the Honeysuckle family.

Very rare in this vicinity, but more abundant in the Western States. It is found from New York to Texas. In fresh examples just emerged from the pupa the transparent portion of the wings is thickly powdered with black scales, which are lost in flying.

In general appearance it resembles *H. diffinis*, but the outer margin is not as much rounded and the body is more elongated, and the outer border is more or less toothed inwardly, while in *diffinis* it is even.

Synopsis of Species of Macroglossinæ.

Hemaris.

- Color olive green and reddish brown; wings transparent centrally.
  - Discal cell crossed by a longitudinal bar of scales.
    - Outer border of fore wings strongly dentate inwardly......*H. thysbe.*
    - Robust; wings broadly bordered with reddish brown, vitreous space small.................................var. *floridensis.*
    - Outer border of fore wings not dentate inwardly......var. *uniformis.*
  - Discal cell without the longitudinal bar of scales.
    - Underside of thorax with reddish lateral shades..........*H. gracilis.*
- Colors black and yellow.
  - Outer border of fore wing broad and dentate inwardly..*H. axillaris.*
  - Outer border slightly or not dentate inwardly.......var. *marginalis.*
  - Outer border of fore wing narrow, not dentate inwardly...*H. diffinis.*

Subfamily CHŒROCAMPINÆ.

Aellopos *Hübner.*

Body depressed, smoothly scaled, and of almost equal width throughout; abdomen with sides almost parallel, last segment slightly narrower, with a broad, long-haired, flat, fan-like tuft; underside of body flattened, with the vestiture from above overlapping along the sides, in form of short tufts. Head broad, prominent; eyes not prominent, palpi pointed. The vestiture of the head, palpi and thorax are closely applied, appearing to form one piece. Legs not spinose; middle tibiæ with short terminal spurs, hind tibiæ with two pair of spurs. Antennæ of almost equal width, with a short, pointed, recurved hook at the tip. Fore wings with apex acute, costa and inner margins straight, outer margin oblique. Hind wings small, apex rounded, anal angles produced.

Aëllopus fadus (*Cram.*).

PLATE III, FIG. 1.

Fore wings sooty black with an olivaceous tinge, a median, straight, narrow, whitish band from the end of the cell to the inner margin, closely followed by a narrower, second and similar band and an outer arcuate row of white spots from the costa towards the inner margin. Hind wings sooty black. Head, thorax and abdomen sooty brown with an olivaceous tinge, the third segment of the abdomen white (var. *titan*), or concolorous (*fadus*). Expanse, 2.20–2.30 inches=55–57 mm.

This is a Southern species, ranging northward, said to be occasionally found in this vicinity. The early stages are not known. It may be known by its sooty black color and white third segment of the body. It flies in the day time in the hottest sunshine.

Aëllopus tantalus (*Hüb.*).

Similar to the preceding species, but the white band on the primaries is obsolete and the subterminal arcuate band of whitish spots is reduced to two or three irregular spots toward the middle of the wing ; beneath the median band is entirely wanting. It is also smaller. Expanse, 1.80 inches=45 mm.

It is not improbable that this insect will prove to be identical with *A. tantalus*, when the early stages are known. It is a Southern species, and rarely occurs in this vicinity.

Triptogon *Ménétries.*

Body stout, fusiform, head large and broad with prominent eyes ; palpi erect, smooth and reaching about the middle of the front ; proboscis about as long as the body ; antennæ rather short, somewhat thickened towards the end, minutely ciliate in the male, simple in the female, and the tip with a short, pointed, recurved hook. Thorax smooth, with a prominent crest on anterior portion ; abdomen long, conic ; anal tuft small, hardly spreading. Legs unarmed ; middle and hind tibiæ spurred. Fore wings shorter than the body, inserted before the middle of the thorax ; apex obtuse and excavated beneath to vein 5, where it is again excavated to the anal angle, which is decidedly produced ; inner margin excavate for some distance before the apex. Hind wings with apex rounded, somewhat excavated before the anal angle, which is produced into a broad angle.

Triptogon lugubris (*Linn.*).

Wings and body chocolate brown ; fore wings with a darker shade outwardly, and before the middle is an oblique, narrow transverse line ; across the wings are traces of transverse lines, but they are very indistinct. Abdomen with two rows of dark spots along the back, which are absent in some individuals. Underside uniform chocolate brown with traces of transverse lines. Expanse, 2–3 inches=50–75 mm.

Larva.—Head dark green, with a yellow frontal band. Body pale green with dark green dorsal dashes and a dark green subdorsal line, bordered beneath with whitish ; along each side are nine pale yellow oblique bands ; spiracles reddish. Length, 2.40 inches=60 mm.

Food-plants.—Grape and Virginia Creeper (*Ampelopsis*).

This Southern species occasionally occurs in this neighborhood, but very rarely. It is common in the Southern States, Mexico, and the West Indies.

Amphion *Hübner.*

Head small, not sunken into the thorax; palpi forming a point in front of the head; eyes lashed above; tongue almost as long as the body; antennæ fusiform extending to a little beyond the middle of the costa, ciliate beneath in the male, simple in the female, hooked at the end. Thorax well developed and much broader than the head, scales rather closely applied. Abdomen narrowing suddenly to the tip which is provided with a flat fan-like tuft, with the sides rounded and the middle prominently pointed; posterior edge of segments at the extreme sides with short tufts of scales. Anterior and middle tibiæ with a few short spines near the tip; middle and hind tibiæ with small spurs. Fore wings as long as the body, outer margin excavated below the apex, and again above the hind angle, which is prominently produced; inner margin concave before the angle. Hind wings with apex rounded, outer margin excavated before the anal angle which is obtusely produced.

Amphion nessus (*Cr.*).

PLATE II, FIG. 5.

Fore wings rich dark brown, crossed by a darker velvety brown band which is divided at the costa, and with shades of the same color before the outer border; on the costa before the apex is a reddish brown patch, and across the outer third is a narrow buff colored transverse streak, which is sometimes quite obsolete. Hind wings rich, deep brown, with a median reddish brown band. Wings beneath rusty yellow, brown at the outer borders; across the middle of the wings are two very narrow ferrugineous transverse lines. Head, thorax and abdomen rich, deep brown, the latter with a narrow canary yellow transverse band between the fourth and fifth segments. Underside of head and thorax rust colored with a yellowish line on each side; abdomen darker, with two small white tufts on the posterior edge of the segments. Expanse, 1.80–2.50 inches=45–62 mm.

Larva.—Uniform chocolate brown, checkered with black markings and dotted with dark amber, especially along the back, and there are stripes of the same color along the sides; caudal horn reddish. Sometimes the larva is of a bluish green color, with the stripes yellow and seven oblique lateral stripes of the same color. Length, 2.50–3 inches=62–75 mm.

Food-plants.—Epilobium, Ampelopsis, and Grape.

Not common in this vicinity. It is found late in May and early in June, and flies in the hottest sunshine and also in the evening. Found from Canada to Florida, and westward to Iowa.

Sphecodina *Blanchard.*

Body stout, depressed, with the sides almost parallel. Head well developed, with the scales forming a low ridge between the antennæ; palpi closely scaled and forming a blunt point in front of the head; eyes moderate, distinctly lashed above. Antennæ of almost equal width, ciliate in the male, simple in the female, tip gradually tapering into a bent hook. Thorax well developed, rather broader than long, scales smooth in front, rather loosely tufted transversely behind; abdomen as broad as the thorax, last segment slightly tapering, underside somewhat flattened, anal tuft of male long and flat, with a short point in the middle; in the female the tuft is long and cylindrical, with a short lateral bunch of hairs; posterior edges of last segments with raised scales, and laterally with bunches of scales, forming dentations. Legs unarmed, middle and hind tibiæ spurred. Fore wings almost parallel, longer and narrower than the body, apex produced and excavate below and also above the hind angle, the excavate portion with a minute dentation; hind angle produced and excavated on the inner margin. Hind wings dentate along the outer margin, anal angle somewhat produced.

Sphecodina abbotii (*Swains.*).

Plate II, Fig. 6.

Fore wings chocolate brown with a narrow, black oblique line running from the basal third of the inner margin and terminating on the costa at about the middle of the wing; beyond this the wings are paler and several dark streaks run from the inner margin towards the outer border and are lost about the middle wing, above which the lines are strongly dentate, but indistinct. The terminal space is variable dark brown. Hind wings bright yellow at the base, outer border deep blackish brown, containing several pale streaks at the anal angle. Underside of fore wings brownish yellow, with a narrow, strongly dentate black line across the outer third, beyond which the wings are chocolate brown. Hind wings beneath bright yellow at base, costal region scaled with brownish, outer border chocolate; through the middle of the wings are two dentate lines. Head and thorax above chocolate brown with a bluish iridescence; across the thorax are two narrow black transverse lines; abdomen blackish at base, paler and with more or less iridescence across the middle, darker at tip. Expanse, 2.20–2.80 inches=55–70 mm.

Larva.—Chocolate brown, with very narrow transverse lines; a dark dorsal line, and one of the same color along the subdorsum and sides; anal segment provided with a large polished spot instead of a horn. Head dark with a lighter broad band on each side. Sometimes the larva is marked with numerous pea-green patches, oval on the back and irregularly triangular on the sides, with an interrupted subdorsal chocolate-colored line. Head brown with a light green band on each side. Length, 2.20 inches=55 mm.

Pupa.—Deep chestnut brown, paler between the segments. Head-case broad and rounded ; tongue-case concealed and level with the breast ; segments deeply punctured, smooth between the segments ; last segment with a rugose, wedge-shaped point. Length, about 1.40 inches=35 mm.

Food-plants.—Grape and Virginia Creeper (*Ampelopsis*).

Common in this neighborhood. The moth appears in May and early in June, and again during the latter part of July and early in August. When at rest the larva does not assume the attitude of holding up the head common to the larvæ of Sphingidæ, but stretches out at full length. If disturbed it throws its head from side to side, hereby producing a creaking noise. It is found from Canada and eastern United States westward to Iowa.

Deïdamia *Clemens.*

Head small, with a prominent tuft between the antennæ ; eyes small and lashed ; palpi rather short ; antennæ of almost equal width and tapering at the apex which is bent at the tip, but not into a recurved hook, biciliate in the male, simple in the female ; thorax stout, vestiture forming a distinct dorsal ridge. Abdomen conical, anal tuft in the male small, flattened laterally, and forming a rounded bunch in the middle ; in the female the tuft is composed only of a bunch of short hairs. Wings longer than the body, and very similar in outline to *Amphion*, only somewhat less oblique.

Deïdamia inscripta (*Harris*).

PLATE II, FIG. 7.

Fore wings ashen gray with minute brown scales ; before the middle is a transverse brown band incurved on the inner margin, and before this band are some indistinct transverse lines ; median space gray ; across the outer third is a broad brown band, angulated outwardly above the middle and shaded outwardly with brown ; in the pale apical region is a rich brown spot, and a short dentate apical streak. All these markings are ill defined, somewhat confluent, and more or less suffused with brown. Hind wings reddish brown with a somewhat darker terminal band. Underside of fore wings dull fawn color, with an irregular ferrugineous transverse shade outwardly, beyond which the space is dark with a distinct white spot in the apical region ; hind wings ashen brown with indistinct transverse lines. Head and thorax ashen brown, the latter with three more or less distinct transverse whitish lines edged with brown. Abdomen with a row of small brown spots along each side of the back. Expanse, 1.80–2.40 inches=45–60 mm.

Larva.—Body pale green with a yellow subdorsal line ending at the base of the caudal horn, which is whitish at the tip. The segments are also transversely marked with fine black lines. Length, 2 inches=50 mm.

Pupa.—Dark pitchy brown, mottled with testaceous on the wing-cases, thorax and head-case, and also somewhat on the segments ; head-case with a pointed tubercle, and also one on each eye-case, which are surrounded with a sharp ridge ; tongue-case concealed, keel-shaped ; the leg and antennæ-cases are also outlined with sharp ridges ; anterior part of thorax with a transverse mark outlined and divided in the middle by a ridge ; segment deeply punctured, last one provided with a sharp spine. Length, .80-1.20 inches=20-30 mm.

Not common in this vicinity. The moth makes its appearance during the latter part of May and the first days in June, and is probably double brooded. The larva is fully grown about the last of June or early in July. It feeds on the Grape and Virginia Creeper (*Ampelopsis*).

Deilephila *Ochsenheimer.*

Body stout fusiform ; head of moderate size, not sunken into the thorax, smoothly scaled ; eyes rather large ; tongue nearly as long as the body ; antennæ gradually thickening toward the tip, which has a minute, pointed hook ; thorax smooth ; abdomen smooth, segments gradually decreasing in size ; tip pointed, and provided with a bunch of long hairs, forming the anal tuft. Fore wings with apex and hind angle acute, outer margin oblique, entire, inner margin very slightly sinuate. Hind wings with outer margin entire, and a slight projection before the rounded anal angle.

Deilephila lineata (*Fabr.*).

PLATE III, FIG. 2.

Fore wings pale olive brown with a broad oblique buff band running from near the base of the inner margin to the tip of the apex, where the band terminates in a point. The veins are heavily marked with white to the outer space, which is lilac gray. Hind wings black, with a broad, pink median band ; outer border narrow, pinkish, with the fringes white. Head, thorax and abdomen olive brown ; thorax with three parallel white stripes on each side ; abdomen with a row of large black and white spots on each side, and along the middle is a narrow broken white line with a small black spot on each side at the posterior end of the segments. Underside lilac gray with the oblique buff band of the fore wings partly repeated ; the pink band of the hind wings is buff color ; the wings are also minutely dotted with brown. Expanse, 3-3.60 inches=75-90 mm.

Larva.—Yellowish green, with a prominent subdorsal row of elliptical spots, each spot consisting of two black curved lines, inclosing superiorly a crimson space and inferiorly a pale yellow line ; the whole row of spots is connected by a pale yellow stripe edged above with black ; sometimes these eye-like spots are disconnected, or the larva is black with a yellow line along the back and a series of pale yellow spots and darker yellow dots along the sides. This dark form is subject to variation, some specimens entirely lacking the line along the back, and having the spots of different shape. Length, 2.50–3 inches=62–75 mm.

Pupa.—Light brown, head-case prominent, showing the palpi, rugose, as is also the thorax ; segments punctured ; tongue-case not apparent. Length, 1.60–1.80 inches=40–45 mm.

Food-plants.—Purslane (*Portulaca*), Buckwheat, Turnip, Watermelon, Chickweed (*Stellaria*), Dock (*Rumex*), Evening Primrose, Apple, Plum, Currant, Grape and Gooseberry.

This species is found in the United States, Canada, and Cuba. In this vicinity it is common everywhere. It flies early in the evening and often in bright daylight. The larvæ are most commonly found in fields feeding on purslane, which seems to be their favorite food plant. The insect is double brooded, the first brood appearing during June and July, and the second during the latter part of August and early in September.

Deilephila galii, var. **intermedia** *Kirby.*

Plate III, Fig. 3.

Fore wings olive brown with a buff-colored oblique band, running from the hind margin near the base to the apex ; the upper edge of the band is indented, and the lower edge somewhat curved ; the outer border of the wings is lilac gray, base black. Hind wings with a broad pink central band, followed by a narrow black band ; terminal border lilac gray, base black. Thorax olive with a white stripe on each side, running along the head. Body olive with a row of minute white dots along the middle ; first and second segments marked with black on the sides ; the second, fourth, and following segments with white. Underside of thorax dull yellowish brown ; wings buff color with the marking from above somewhat reproduced. Expanse, 2.65–3 inches=65–75 mm.

Larva.—Dark green with nine yellow spots encircled with black on each side ; spiracles yellow with a black ring ; caudal horn red ; head and thoracic feet blue gray. Sometimes the larva is olive green with a bright yellow dorsal line and spots on each side ; or is blackish gray with a red dorsal line and two rows of yellow spots on each side. Length, 3 inches=75 mm.

Pupa.—Pale brown mottled with black in its impressed portions ; head-case projecting, corrugated ; tongue-case concealed, corrugated ; wing-cases corrugated ; segments punctate ; terminal spine tapering, bifid at tip. Length, 1.80 inches=45 mm.

Food-plants.—Epilobium, Purslane (*Portulaca*), Evening Primrose and Apple.

Not common in this neighborhood. Found during June and again in August. It occurs from Canada to Georgia and westward to California ; also in Europe. The median pink band of the hind wings in the European form (*galii*) is much paler than in *intermedia.*

Theretra *Hübner.*

Body long and graceful ; head of medium size and smoothly scaled ; eyes large, hemispherical ; proboscis almost as long as the body. Antennæ minutely ciliate in the male, simple in the female, and of almost equal width throughout, with a small bent hook at the tip ; thorax smooth ; abdomen very long, and tapering to a point, vestiture very smooth and closely applied, and a narrow brush of hairs at the tip. Fore wings long and narrow, apex sharply pointed, outer margin very oblique, inner margin sinuate ; Hind wings narrow, apex pointed, sharply produced before the anal angle.

Theretra tersa (*Linn.*).

Plate III, Fig. 4.

Fore wings ochreous brown, paler at the base, which has a slight purplish reflection ; from the apex to the middle of the inner margin is a series of from seven to nine diverging, oblique light brown lines ; the outer ones are almost parallel with the outer border, and the inner ones extend nearly to the base of the wing. Hind wings smoky black with a series of large wedge-shaped, yellow subterminal spots. Head and thorax fawn color, with a roseate lateral stripe ; abdomen rusty brown above with indistinct fawn-colored stripes ; sides rusty yellow ; underside paler. Expanse, 2.25–3 inches = 56–75 mm.

Larva.—Pale green, with fine longitudinal irrorations ; along the subdorsum is a rather broad white band, running from the fourth segment to the caudal horn ; on the band is placed, on each segment, a round black ring, the one on the fourth segment with a black eye-like spot in the centre. Caudal horn reddish, tip black. Length, 2.40 inches=60 mm.

Food-plants.—Bouvardia, Buttonweed (*Spermacoce glabra*), *Manettia bicolor.*

Quite rare in this vicinity, but common in the Southern States, West Indies, Central and South America. It ranges northwardly as far as Canada. It is usually found in flower gardens. The moth may be easily recognized by its graceful form. It varies somewhat in ground color from light to dark ochreous brown.

Argeus *Hübner.*

Form robust; head large and prominent; eyes large, not lashed; thorax stout, well advanced in front of the base of the fore wings; abdomen long and robust. Fore wings shorter than the body, outer margin obliquely rounded, inner margin sinuate; hind wings entire with anal angle produced.

Argeus labruscæ (*Linn.*).

Plate V, Fig. 6.

Fore wings green, with a large V-shaped deeper green space; beyond this are two somewhat deeper green transverse lines; a series of small black subterminal spots, and a rather large rounded brown patch about the middle of the wings. Hind wings blue, with a median black band, in which is a blue spot, and marked with red towards the inner margin; in front of the outer border is another black band; outer portion of wings buff colored. Head, thorax, and abdomen green; abdomen with a series of white lateral spots. Expanse, 4.25–4.75=106–119 mm.

A South American species, occurring northward to Canada. In the north it is an occasional visitor, and is very rarely taken.

Pholus *Hübner.*

Body robust; head large, smoothly scaled; eyes large, not lashed; antennæ ciliate in the male, simple in the female, hooked at the tip; thorax stout and smooth; abdomen stout, smooth and gradually tapering. Tibiæ not spinose, middle pair with two unequal terminal spurs, hind tibiæ with two pairs. Fore wings much longer than the body and broad, outer margin rounded and somewhat excavated below the apex or obliquely rounded, inner margin strongly sinuate. Hind wings broad, apex pointed, outer margin somewhat excavate before the anal angle.

Pholus pandorus *Hübner.*

Plate III, Fig. 5.

Fore wings pale olive green, marked with patches and shades of rich olive green; on the inner margin near the base, is a long olive green patch running to about the middle of the wing, and separated by a pink shade from the triangular patch within the hind angle; a similar patch rests on the costa a little before the apex, there is also a dark olive shade from the costa extending outwardly; across the wing are several narrow, wavy, indistinct lines; discal spot consisting of two or three small blackish spots at the end of the cell.

Hind wings pale greenish at base, with a black patch at the middle of the inner margin, and a broad black subterminal band running from the costa to the middle of the wing, where it breaks up into spots and lines on a roseate ground; outer margin olive green. Head and thorax with a blackish line along the middle, thorax at sides with an olive green triangular patch. Underside pale olive, with two narrow transverse lines on each wing. Expanse, 3.75–4.50 inches=95–112 mm.

Larva.—Pale green above, darker at sides, or reddish brown, lighter dorsally; at the sides from the fifth to tenth segments each with an oval cream-colored spot in which are the spiracles. Last segment with a black, polished, eye-like spot instead of a caudal horn; anterior segments with numerous, minute black dots. Head small and rounded. Length, 3 inches=75 mm.

Pupa.—Elongate, chestnut brown. Head-case prolonged, subtriangular laterally, slightly corrugated; wing-cases smooth; tongue-case concealed, and extending slightly beyond the wing-cases; segment thickly punctured; middle portion of pupa thicker than either extremity; terminal spine rather long, pointed and minutely bifid. Length, 2.50 inches=62 mm.

Food-plants.—Grape and Virginia Creeper (*Ampelopsis*).

Rather common in this neighborhood, in gardens and vineyards. It is double brooded; the first brood appearing during June and early in July, and the second in August. It is found in the United States east of the Great Plains and also in Canada.

Pholus achemon (*Drury*).

PLATE III, FIG. 6.

Fore wings pale chocolate brown with a pinkish tinge, with darker shades and several wavy transverse lines; on the inner margin at the middle is a large, deep velvety brown quadrate patch, and a small triangular patch of the same color before the hind angle, and a larger one on the costa immediately before the apex. Hind wings pink with a light chocolate-brown outer border, containing a row of deep brown spots, which are not clearly defined before the middle of their course. Head, thorax and abdomen same color as the upper wings, the thorax with a deep triangular patch on each side. Underside of fore wings roseate with a pale chocolate-brown outer border and with two parallel, deeper brown transverse lines; hind wings roseate brown, powdery, with two transverse lines. Expanse, 3.75–4.25 inches=95–106 mm.

Larva.—Varying from green to reddish brown or pale straw-color, darker along the sides ; an interrupted brown line runs along the middle of the back, and an unbroken one extends along each side, beneath which are six cream-colored oblique spots, one on each segment ; on the last segment is a polished black, flat tubercle, instead of a caudal horn. Over the body are sprinkled numerous minute dark dots. Length, 3 inches=75 mm.

Pupa.—Very similar to that of *P. pandorus*, but less elongated, and the head-case less prolonged and pointed ; the last segments are broader and the terminal spine shorter and obtuse, instead of pointed. Length, 2-2.25 inches=50-56 mm.

Food-plants.—Grape and Virginia Creeper (*Ampelopsis*).

This species is double brooded, the first brood appearing in June and July, and the second in August. It is somewhat common in this vicinity, and is found throughout the United States from the Atlantic to the Pacific, and also in Canada. The larva, in shape and size, is the same as that of *P. pandorus*, but differs in shape of the spots along each side, which are elongated instead of oval as in *pandorus*.

Pholus vitis (*Linn.*).

Plate III, Fig. 7.

Fore wings deep olive green, with a pale flesh-colored band extending from the middle of the base to the apex and crossed by a similar band which runs from the outer fourth of the costa to the middle of the inner margin ; the costa to the transverse band is chocolate brown, as is also the outer border ; between the oblique transverse band and the outer border the veins are pale flesh-colored ; at the basal third of the wing is a narrow line running from the band to the inner margin. Hind wings pale greenish inwardly, with a broad pink outer border interrupted by an olive green space before the angle ; within the outer border is a broad black fascia terminating in two narrow lines ; below the disc are two large black spots, separated by a few pink scales. Head, thorax and abdomen flesh-colored, head and thorax with a median olive green line, and an elongate olive green patch on the patagia ; abdomen with a blackish patch on each side of the base, and on each side of the back a broad olive green stripe. Underside of wings pinkish flesh color, roseate at the inner margin of the hind wings. Expanse, 3-4.25 inches=75-106 mm.

Larva.—Head claret red with two black stripes ; body yellowish, with narrow transverse black lines, junctions of segments claret red ; along the sides are a series of elongate, oblique, oval, whitish patches ; beneath greenish with black lines. Length, 3 inches=75 mm.

Pupa.—Shape similar to that of *P. pandorus*, but differs in having only the anterior parts of the segments, as is also the prolonged head-case; the last segment is more rounded, and the terminal spine is somewhat curved and polished at the base. Length, 2.20 inches=55 mm.

Food-plant.—Grape.

This is a southern species very rarely taken in this vicinity. It has been recorded from South America, Central America, Cuba, Texas, Florida, and along the Atlantic coast to Massachusetts. The larva is very different from its congeners.

Pholus linnei (*G. & R.*).

Closely allied to *P. vitis*, but differs in having the outer border of the fore wings rounded instead of being straight as in *vitis*. The markings of the fore wings are darker, and the hind wings are greenish at base, with the outer border grayish brown, instead of pink, and at the anal angle is a pink patch and a black patch within. Expanse, 3.25–4.5 inches=81–1.12 mm.

Inhabits South and Central America, Cuba, and the Southern States, and is said to be found northward as far as Massachusetts; if so it may possibly be found in this vicinity.

Everyx *Ménétries.*

Head small, vestiture forming a central ridge or tuft between the antennæ; eyes moderate and slightly lashed; proboscis about half as long as the body; antennæ ciliate in the male, simple in the female, with a large hook at the tip. Tibiæ not spinose, except in *E. chœrilus*, which has the anterior and middle pair minutely spinose. Thorax prominent, smooth; abdomen untufted, smooth and tapering. Fore wings as long as the body, rather broad, apex subfalcate, outer margin more or less excavate, inner margin sinuate. Hind wings excavate before the anal angle, apex rounded.

Everyx chœrilus (*Cramer*).

PLATE II, FIG. 8.

Fore wing rusty brown with slight purplish reflections; basal half grayish brown with two curved transverse lines; outer part of wings rusty brown crossed by several more or less distinct zig-zag lines; terminal space same color as the base of the wings. Hind wings uniform rusty red with a very narrow fringe, edged with white. Head, thorax and body rusty brown, patagia edged with gray. Underside of wings pale rusty brown with two faint transverse lines on each; outer border of fore wings same as above. Expanse, 2.25-3 inches=56–75 mm.

Larva.—Body pale green, with a darker dorsal line; second segment yellowish green with numerous irrorations. Spiracles orange, white above and below, those on second segment are orange and yellow above and below; along each side of the 5th, 6th, 7th and 8th segments is a white oblique band, and on the posterior segments the bands are connected with a continuous line to the base of the caudal horn, which is bluish at the base, green at the tip and white in the middle. Sometimes the color of the larva varies from pinkish to brown or even leaden brown. Length, 2.20 inches=55 mm.

Pupa.—Purplish brown, with a pink tint over the whole surface, and slightly mottled with black. Wing-cases mottled with black, spaces between the segments blackish brown. Tongue-case concealed. Length, 1.40 inches=35 mm.

Food-plants.—Sheep-berry (*Viburnum lentago*), Arrow-wood (*Viburnum dentatum*), also other species of *Viburnum*, Sour-gum (*Nyssa*), and Azalea.

This is a rather common species, and is found in open woods. It may be easily recognized by its rusty brown color and purplish-gray shades on the fore wings. It is double brooded. The larva spins a rude cocoon, amongst leaves on the surface of the ground. Found from Canada to Georgia, and westward to Iowa.

Everyx myron (*Cramer*).

PLATE II, FIG. 9.

Fore wings olive gray, varying to purplish gray, with olive green, oblique, transverse bands and shades, which are more or less distinct. The band across the basal third is continuous, while the band across the outer third is nearly always more or less broken in the middle by the pale ground color. The outer part of wing is shaded with olive green at the apex and inner angle, leaving the rest of the terminal space olive or violet gray. Hind wings rusty brown with a darker, more or less distinct and complete terminal band. This band is very often reduced to an olive gray patch on the anal angle. Head, thorax and abdomen olive green or gray. Underside pale rust red or grayish, with two narrow transverse lines. Expanse, 1.80-2.50 inches=45-62 mm.

Var. **cnotus** *Hübn.*—In this variety the fore wings are uniform brown, without traces of the olive transverse bands and shades.

Larva.—Body green sprinkled with yellow dots; along the middle of the back is a row of yellow patches, each containing a spot varying from red to pale lilac; along the sides, from the head to the caudal horn, is a white stripe with a dark green margin, and below this are seven oblique lateral stripes. The caudal horn varies from red to bluish, granulated with black, and is sometimes yellow behind and at the tip. The larva is sometimes green, cream color, purplish brown, deep brown, or leaden brown. In some the yellow patches along the back are almost wanting. Length, about 2 inches=50 mm.

Pupa.—Shape like that of *E. chœrilus.* Pale brown; wing-cases sprinkled with black dots; junctions of segments dark brown. Tongue-case concealed. Length, about 1.20–1.40 inches=30–35 mm.

Food-plants.—Grape and Virginia Creeper (*Ampelopsis*).

Rather common in gardens about grape vines. It may be readily known by its olive gray color with olive green markings. The larva in shape is like that of *E. chœrilus*, but differs in having the lateral oblique stripes interrupted by the lateral white line, which forms a straight edge at the junction of the oblique lines. It also differs in having a row of sub-oval dorsal spots, which are absent in *E. chœrilus.* When fully grown it spins a loose cocoon amongst leaves on the ground. It is double brooded, the first brood appearing in June and July and the second in August. It is found from Canada to Georgia, and westward to Missouri and Iowa. The variety *cnotus* is rare, but is the common and prevailing form in the Southern States.

Everyx versicolor (*Harris*).

PLATE II, FIG. 10.

Fore wings green shading into lighter green or yellowish green, with a number of transverse whitish or pinkish lines. Several more or less distinct curved lines run from the costa before the middle to the base of the wing, and beyond the middle, across the outer fourth, are also three more or less distinct transverse lines and a curved subterminal white line beginning at the apex and running irregularly down to the anal angle; near the apex it is crossed by two white dashes; sometimes this line is almost absent. Hind wings rust brown, the margin grayish. Head, thorax and abdomen green tinged with yellow; a narrow white line extends over the top of the head to the end of the abdomen; along the sides of head and thorax also a whitish line. Underside of wings marked with green, yellow and white, sometimes with reddish on the fore wings. Expanse, 2.75–2.90 inches=68–72 mm.

Larva.—Head and first four segments yellowish green; rest of body pea green, with a white line along each side from the mouth to the base of the caudal horn; this line is composed of several lines, as follows: a subdorsal line, extending from each side of the mouth back to the rear of the fourth segment of the body; a similar line runs obliquely from the lower part of the fourth segment, just under the stigmatal point, upwards and backwards to the rear of the fifth segment, meeting it just below the dorsal line. This is followed by five other parallel lines, each beginning and ending one segment further back, except the last, which extends across the last three segments up to the base of the caudal horn. There are also faint indications of other lines at the lower part of the tenth and eleventh segments ; body also covered with white specks. Spiracles red, with yellow at each end. Caudal horn black, red on the sides. Sometimes the ground color is pinkish brown instead of green, and the markings are then pinkish white. Length, 2.50–3 inches=62–75 mm.

Pupa.—Dirty brown, with chocolate brown spots, almost covering the wing-cases and anterior parts ; eyes and spiracles black, as also between the segments ; tongue-case concealed.

Food-plants.—Buttonbush (*Cephalanthus occidentalis*) and Swamp-loosestrife (*Nesæa verticillata*).

Quite rare and local in this vicinity. It is double brooded, appearing in June and early in July and again in August. The moth may be easily known by its bright green shades on the fore wings, with the more or less distinct whitish transverse lines. The larva is very quiet in its habits, never leaving a stem of the food-plant so long as a leaf remains. In eating, when fully grown, it hangs from the mid-rib of the leaf, and eats usually from the extreme end, finishing a section across the leaf as it goes. It generally eats the mid-rib and petiole down to the woody stem.

Synopsis of Species of Chœrocampinæ.

Aëllopos.

Abdomen with a broad fan-like anal tuft. Wings entire.
  Sooty black ; abdomen with the third segment white.
    Fore wings with two transverse bands beneath the cell and an arcuate row of subterminal spots.................... *A. fadus.*
    Fore wings with the bands obsolete, and the subterminal row of spots reduced to two or three spots.................. *A. tantalus.*

Triptogon.

Fore wings excavate, below the apex and above the hind angle.
  Chocolate brown with darker shades outwardly on the fore wings.
    Thorax with a prominent tuft on the fore part......... *T. lububris.*

Amphion.

Fore wings excavate outwardly ; rich dark brown with darker markings.
  Abdomen with a transverse, canary yellow line between the fourth and fifth segments.................................... *A. nessus.*

Sphecodina.

Fore wings excavate outwardly ; last segments of abdomen with dentate lateral tufts.
  Dark brown, fore wings with oblique streaks ; hind wings yellow at base. .... *S. abbotii.*

Deidamia.

Fore wings excavate outwardly, head with a prominent tuft.
  Ashen gray with brown markings ; hind wings reddish brown, *D. inscripta.*

Deilephila.

Wings entire, not excavate ; fore wings with a buff-colored oblique band from the base to the apex.
  Veins of fore wings and thorax lined with white......... ....*D. lineata.*
  Veins and thorax not lined with white..........*D. galii* var. *intermedia.*

Theretra.

Body long and graceful, wings pointed, entire.
  Pale ochreous ; fore wings with paler oblique stripes ; hind wings black with a subterminal row of yellow wedge-shaped spots, *T. tersa.*

Argeus.

Outer margin of fore wings not excavate beneath the apex.
  Fore wings wholly green, with a darker V-shaped space.
    Hind wings blue, black, red and buff.................*A. labruscæ.*

Pholus.

Large species ; wings broad ; fore wings slightly excavate beneath the apex.
  Fore wings pale olive green, with dark green shades and patches.
    Hind wings pale green with a black patch and subterminal band, *P. pandorus.*
  Fore wings pale chocolate brown, with rich, dark brown patches.
    Hind wings pink, outwardly pale brown.......... ....*P. achemon.*
  Fore wings deep olive, with an oblique flesh-colored band from the middle of the base to the apex, and an oblique transverse band of the same color.
    Hind wings pale green at base, pink outwardly, and with a black spot and short band ....*P. vitis.*
    Hind wings pale greenish at base, black outwardly ; anal angle with a pink patch.... ....*P. linnei.*

Everyx.

Fore wings with apex subfalcate, entire.
  Olive gray, with olive green markings, hind wings red brown...*E. myron.*
  Rusty brown ; basal half of fore wings pale grayish brown...*E. chœrilus.*
  Light and dark green, with white transverse lines on fore wings ; hind wings ferrugineous ; from head to end of body a white line, *E. versicolor.*

Subfamily SPHINGINÆ.

Dilophonota *Burmeister.*

Body long ; fore wings as long as the body ; head large, smoothly scaled ; eyes large ; tongue about half as long as the body ; antennæ minutely ciliate in the male, simple in the female, tip with a short hook ; thorax smooth, with a short, divided rest on the middle of the anterior portion ; abdomen smooth, slender. Legs unarmed; middle and hind tibiæ spurred. Fore wings with the outer margin oblique and slightly scolloped between the nervules. Hind wings with apex acute, anal angle somewhat produced.

Dilophonota ello (*Linn.*).

PLATE IV, FIGS. 1 AND 2.

Fore wings ashen gray, with an indistinct, dentate line running from the outer fourth of the costa to the middle of the hind margin, and an outer row of small dark spots. Often there is a brown shade from the middle of the base to the apex, and above and below this shade the wings are also marked with brown, forming no regular pattern. Hind wings ferrugineous, terminal border blackish, not reaching the anal angle, and grayish before the angle. Head and thorax ashen gray or marked with brown. Abdomen gray with five large, transverse, oblong spots on each side, with the space on the back forming a line. Underside of wings ferrugineous, dusky outwardly; body light gray. Expanse, 3–4 inches=75–100 mm.

Larva.—Body green; head with a dark brown line on each side in front, thence running over the top of the head and along the subdorsum of the body and converging at the base of the caudal horn; these lines are bordered with yellow; on the fourth segment is a large, round, velvety black spot bordered with yellow, and outside on either side is a shade of deep reddish brown; on the middle of the back from the head to the end of third segment is a fine dark brown line; abdominal feet with a velvety black patch externally; caudal horn short and blunt. The body is also sprinkled over the surface with minute dark brown and yellow dots. Sometimes the larva is reddish brown, with the lines less distinct than in the green variety. Length, 3–3.50 inches=75–87 mm.

Pupa.—Pitchy black, smooth, and very shining wing-cases and breast with longitudinal ochreous lines; thorax and head-case also with ochreous lines; abdominal segments ochreous with short black transverse lines and dots, last three segments pitchy; anal spine smooth, compressed, and in form of a triangular tooth. Head-case prominent and smooth. Length, 2–2.25 inches= 50–56 mm.

Food-plant.—Euphorbia.

Very rare in this vicinity but common in the South. It is found from Brazil northward to Canada. It varies from an almost uniform gray to a form with distinct brown shades.

Phlegethontius *Hübner.*

Head very large and prominent; eyes large; proboscis much longer than the body; antennæ rather strongly biciliate in the male and simple in the female ; thorax robust, well advanced in front of the base of the fore wings, and with short erect tufts posteriorly ; abdomen tapering, untufted. Fore wings well developed, somewhat longer than the body, outer border obliquely rounded and entire; apex acute; hind wings with outer margin very slightly scolloped.

Phlegethontius quinquemaculatus (*Haw.*).

PLATE IV, FIG. 3.

Fore wings ashen gray, shaded more or less with blackish beyond the middle and toward the apex ; across the wings from the costal third is a series of three narrow black lines running outwardly, then obliquely backwards to the inner margin near the base ; across the outer fourth are three much angulated, parallel lines running to the middle of the inner margin; beyond these lines is a less angulated, darker and more distinct line, and a short apical streak of the same color. All the lines are more or less ill-defined. Hind wings pale gray, ashen gray outwardly, and are crossed by two parallel dentate lines through the middle and with a rather broad subterminal black band, widest at the costa. Head and thorax ashen gray, the latter marked with several short transverse lines in front, one along the edge, and another through the middle of the patagia ; across the hind part of the thorax is a broad black band, with, in front of it, one or two spots composed of bluish tufts. Abdomen gray with a row of large, conspicuous, orange colored spots surrounded with black along each side and edged on the anterior parts above and below with white. Underside of wings uniform ashen gray, with two transverse bands on each, the outer one on the fore wings and those on the hind wings toothed. Expanse, 3–4.50 inches=75–112 mm.

Larva.—Body dull green with yellowish white, oblique lateral stripes, or dull sea green with ocellated spots anteriorly with the oblique lateral bands and stigmatal stripe flesh color ; head black with an elongated flesh colored triangular patch ; thoracic feet, exterior of prolegs, and anal plates black. Underside paler than above. Sometimes the body is very dark brown sprinkled with yellow dots ; and the lateral oblique bands and the stigmatal stripe are yellow, as is also the border of the caudal shield ; head with triangular spot drab ; caudal horn black, spiny. Length, 3–4 inches.

Pupa.—Chestnut brown ; tongue-case detached, very long, prominent, and strongly curved, like the handle of a pitcher, with the bulbous end touching the body beyond the middle of the wing-cases. Length, about 2.50 inches= 62 mm. ; tongue-case, 30 mm.

Food-plants.—Tobacco, Tomato, Jamestown-weed (*Datura*), Matrimony Vine (*Lycium vulgare*), and Ground Cherry (*Physalis viscosa*).

Not common, and double brooded in this vicinity. The first brood appears in June, and the second in August. It may be known by its ashen-gray color and the five orange spots on each side of the abdomen. Found throughout the United States and Canada. The pupa is a well-known object of interest, and from its long arched tongue-case may be readily distinguished.

Phlegethontius carolina (*Linn.*).

PLATE IV, FIG. 4.

Fore wings dark brownish gray, with the transverse lines near the base and across the outer fourth very similar to those of *P. celeus.* The outer dark transverse line is scalloped, while in *celeus* it is slightly curved, and beyond this is a subterminal angulated whitish line. Discal spot small, white. Hind wings gray, with three transverse black bands, outer portion dark gray. Head and thorax brownish gray with yellow scales, the latter with indistinct black lines and black across the posterior part. Abdomen wood brown or gray with a row of large, deep orange spots along each side, which decrease in size towards the end of the abdomen and are surrounded with black. Underside of wings gray with transverse bands. Expanse, 3–5 inches=75–125 mm.

Larva.—Green, paler above, with seven oblique white bands, bordered above on each side with bluish or dark brown, last segment edged with white; caudal horn reddish, white at the base of sides, or wholly black. Over the body are also scattered fine, short, transverse lines. Length, 2.80–3.50 inches =70–80 mm.

Pupa.—Chestnut brown, and similar in shape to that of *P. celeus*, but less swollen at the middle, the detached tongue-case is shorter and much less arched, and does not quite extend half-way to the end of the wing-cases. Length, about 2.20 inches=55 mm.; tongue-case, 23 mm.

Food-plants.—Tomato, Tobacco, and Jamestown-weed (*Datura*).

Closely allied to *P. celeus*, but is a much darker insect, the yellow spots on the abdomen are much larger, and the central bands on the hind wings are straight instead of toothed. It is found in the United States from the Atlantic to the Pacific, in Canada and the West Indies. In this vicinity it is sometimes quite common and double brooded.

Phlegethontius cingulatus (*Fabr.*).

PLATE IV, FIG. 5.

Fore wings dark gray, sometimes mottled with brown; darker than in *P. celeus*, and lighter than in *P. carolina.* The transverse lines are almost like those of *P. carolina.* Below the cell, between the veins, are two black streaks. Hind wings rose colored at the base, gray outwardly, and crossed by three black bands. Head and thorax dark gray, the latter with black lines at sides and in front; abdomen dark gray with five bright rose colored spots on each side, decreasing in size towards the posterior end of the body, and separated by black bands. Underside of wings dark gray; hind wings white at base along the inner margin. Expanse, 3.75-4.50 inches=94-112 mm.

Larva.—Dark green with seven oblique black bands along each side, which terminate on the back in two longitudinal stripes of the same color; on the dorsum of the third and fourth segments are two black spots, four very small ones on the tenth, and two very large ones placed laterally at the incisure of the first and second segments. Head green with black stripes. Caudal horn yellow or ferrugineous, tip black; anal shield orange yellow. Length, 3-4 inches= 75-100 mm.

Variety A.—Clear green, with the oblique lateral bands entirely white, and the two dorsal stripes replaced by two rows of black points.

Variety B.—Dull green with six longitudinal rows of blackish or brownish spots, and the head and horn ferrugineous.

Variety C.—Dead leaf brown on the back, white on the sides, and flesh colored beneath; seven oblique lateral stripes of deeper brown and a lateral stripe of straw color, which is continuous on the first three segments, and interrupted after the fourth segments at the middle of each. Head pale fawn color with black lines; caudal horn black; shield orange.

Variety D.—Brown with four longitudinal lines of dirty white on the first three segments, two dorsally and two laterally.

Variety E.—Earthen brown with the back and oblique bands of a deeper brown.

Pupa. Brown, with the tongue-case detached, not reaching the middle of the wing-cases, bent downward and backward for about half its length; the turned portion resting on the breast. Length, 2.50 inches=62 mm.

Appears in June and again during the latter part of August and in September. It may be known from the other members of the genus by the rose red spots on the abdomen. The larva is very variable, and besides the varieties described above, intermediate ones are met with. It hides itself at the base of the plant under leaves, but may be discovered from its large excrements. The insect is found from Canada to Brazil, and to the extreme west of our continent; also in the Hawaiian Islands.

Phlegethontius rusticus (*Fabr.*).

Plate IV, Fig. 6.

Fore wings sooty brown, with white transverse wavy lines across the basal and outer third, and subterminal white markings of no regular pattern; sometimes the wings are more or less rust brown. Hind wings sooty brown with a whitish band near the base and two more or less distinct, black central bands, followed by whitish shades. Fringes black, cut with white. Head, thorax and abdomen sooty black, or marked with rust brown, thorax marked with white; abdomen with three large orange spots on each side. Underside of fore wings paler than above with transverse lines; hind wings whitish or grayish with two dentate central bands; body white. Expanse, 3.50–5.60 inches= 87–140 mm.

Larva.—Head and body dark green, yellow on the dorsum; along each side are seven oblique blue bands edged with purple, and beneath these is a white longitudinal band, edged with yellow on the lower part. Caudal horn yellow, with reddish tubercles. Length, 4 inches=100 mm.

Pupa.—Chestnut brown, and similar in shape to that of *P. carolina*, but larger and more robust, with the detached tongue-case more curved. Length, about 2.50–2.80 inches=62–70 mm.

Food-plants.—Chionanthus, Privet, and Lilac.

Found from New York southward into South America. In this vicinity it is very rare. It may be known by its large size, sooty-brown color, the white wavy lines, and by having three yellow spots on each side of the abdomen.

Sphinx *Linnæus.*

Head moderate; proboscis as long as the body; eyes small, usually distinctly lashed; palpi curved upward and projecting beyond the head; antennæ with the tip more or less bent; thorax well developed, untufted, metathorax with erect hairs. Legs more or less spinose; middle and hind tibiæ spurred. Fore wings with very acute apex and the outer margins very oblique, entire. Hind wings narrow, apex distinct.

Sphinx drupiferarum *A. & S.*

Plate V, Fig. 1.

Fore wings smoky black, broadly grayish or whitish along the costal region from the base of the wings to nearly the apex; the outer margin is also grayish, containing a whitish line which is limited inwardly by a wavy black line; between the veins in the dark portion of the wings are several black dashes. Hind wings black, base whitish, and also a central whitish band; terminal border dirty grayish brown. Thorax black, sides grayish, as is also the head. Abdomen brownish, with a fine black line along the middle; sides black, with a row of four or five large white spots. Underside: fore wings smoky, terminal border grayish brown; hind wings grayish at base and a central band and outer border of the same color. Expanse, 3–4 inches=75–100 mm.

Larva.—Bright apple green; head with a dark brown stripe on each side; along each side of the body are seven oblique white stripes bordered with purple on the upper side; spiracles orange; caudal horn dark brown, yellow at the base of the sides. Length, about 3.50 inches=87 mm.

Pupa.—Dark chestnut brown; tongue-case detached, short and straight, and not resting on the breast. Length, about 2 inches=50 mm; tongue-case, .25 inch=6 mm.

Food-plants.—Apple, Plum, Hackberry (*Celtis*).

Not common. Double brooded in this vicinity, appearing in June and again early in August. The species is recognizable by the smoky black fore wings and the whitish costal space. Found from Canada to Florida and westward.

Sphinx kalmiæ *A. & S.*

PLATE V, FIG. 2.

Fore wings pale chestnut brown, with lighter and darker streak-like shadings; before and parallel to the outer border is a pale brownish white transverse line, limited inwardly with black; fringes alternately brown and whitish. Hind wings brownish white with a central and subterminal blackish band. Head and thorax chestnut brown on top, patagia edged with black; sides of head and thorax pale whitish brown. Abdomen chestnut brown along the back with a narrow black line; sides black, with a row of large whitish spots. Underside of wings chestnut brown, with a terminal dark brown shade, and a paler central band across the hind wings. Expanse, 3–4.50 inches=75–112 mm.

Larva.—Body apple green, paler above and dark at the sides, with seven oblique lateral stripes, which are whitish along the middle, bordered with blue-black anteriorly and with yellow posteriorly. Caudal horn light blue, with black tubercles. Spiracles pale orange, thoracic feet black, whitish at their bases; abdominal legs with two black spots externally, and separated by yellow. Length, about 3 inches=75 mm.

Pupa.—Deep chestnut brown, with the detached tongue-case short and straight, and is similar in shape to the pupa of *S. drupiferarum.* Length, about 2 inches=50 mm.

Food-plants.—Laurel, Lilac, Privet, *Chionanthus*, and Ash.

Not common. It may be known by its chestnut brown color, with lighter and darker streaks. The larva is quite conspicuous, with the lateral oblique stripes very broad. It is double brooded, the first brood appearing in June and the second late in July and early in August. Found from Canada to Georgia, and westward to Missouri.

Sphinx lucitiosa *Clemens.*

PLATE V, FIG. 3.

Fore wings rusty brown with the costa and outer margin sooty brown; most of the veins are finely marked with blackish. The band on the outer margin gradually narrows as it nearly reaches the apex; before this band, from the inner margin, is a light brownish oblique wavy streak. Discal dot small, whitish. Hind wings ochre yellow with traces of a dark central band and a broad black outer border. Thorax and top of head sooty black; sides of head and thorax pale brownish gray. Abdomen dull ochre yellow, with a narrow black dorsal stripe, a black band along each side, broken by whitish spots on the edges of the segments. Underside of wings pale ochreous yellow, with a smoky brown outer border. Expanse, 2.50–3 inches=62–75 mm.

Larva.—Head pale green with a yellow line on each side, indistinctly edged above with black; mouth parts black; body green; the first three segments and the lower half of all the others covered with small white dots, each dot encircled with black; on each side are seven oblique stripes, white, with pinkish lilac above. Thoracic legs white with red tips; abdominal legs green with a faint purplish tinge; caudal horn rather short, green with a black stripe on each side; spiracles red. Length, 3.50 inches=87 mm.

Pupa.—Bright mahogany brown, with a short detached tongue-case. Length, 1.59 inches=37 mm; tongue-case, .125 inch=3 mm.

Food-plant.—Willow.

Very rare in this vicinity. It may be known by its brown color and ochre yellow hind wings.

Sphinx gordius *Cramer.*

PLATE V, FIG. 4.

Fore wings gray, more or less clouded with sooty brown; veins finely marked with black, with a few dashes of the same color between them and in the cell; outer border of wing sooty black, the band gradually narrowing as it reaches the apex. Discal spot white. In some individuals there are traces of a few transverse dark bands, one across the basal fourth, one across the middle, and another a little beyond. Hind wings dirty white, with a central black band and a broad black outer border. Head and vertex of head sooty black, sides grayish. Abdomen grayish, with a black dorsal line ; sides black and white in form of bands. Underside of fore wings smoky ; hind wings marked as above, but paler. Expanse, 3–3.60 inches=75–90 mm.

Larva.—Bright apple green, with a yellow and brownish stripe on each side of the head ; along the sides of the body are seven short, oblique stripes, which are white and margined above with carmine. Caudal horn black, green on top and beneath. Length, about 2.50 inches=62 mm.

Pupa.—Deep brown, with a very short detached tongue-case. Length, 1.40 inches=35 mm.

Food-plants.—Apple, Pear, Ash and Wax-Myrtle (*Myrica*).

This species is allied to *S. lucitiosa*, but may be separated by its gray color and differently marked hind wings, which are ochre yellow in *S. lucitiosa*. It is not common in this vicinity, and is double brooded. It ranges from Canada to Georgia, and westward to the Mississippi, and probably further westward.

Sphinx chersis (*Hübner*).

PLATE V, FIG. 5.

Fore wings light ashy gray with a small bunch of blackish scales at the base of the inner margin ; between the veins, from beneath the cell to the apex, is a short black dash between each, the last one almost uniting with a short black apical streak ; before the outer margin is a narrow transverse black and whitish line. Hind wings whitish with a black central band and a terminal band. Head and thorax light gray ; patagia lined inwardly with black, and a tuft of the same color on each side of the posterior edge of the thorax. Abdomen gray, with a central black line ; sides black and broken by white cross-stripes. Underside of wings gray with an ill-defined subterminal band on the fore wings and a pale dentate, median band on the hind wings. Expanse, 4–5 inches=100–125 mm.

Larva.—Pale apple green ; dorsal region whitish, and with seven oblique yellow stripes along each side. Head with a yellow stripe on each side ; caudal horn pale bluish ; thoracic feet pink. Length, about 3 inches=75 mm.

Pupa.—Deep chestnut brown, with a short detached tongue-case. Length, 2.50 inches.

Food-plants.—Lilac, Privet and Ash.

Double brooded in this vicinity, appearing in May-June and again late in July. It may be known by its uniform gray color, very oblique outer margin and pointed apex. Found from Canada to Georgia, and westward to California.

Sphinx canadensis *Boisd.*

Plate VI, Fig. 1.

Fore wings light brownish gray, streaked with black between the veins, and a terminal black line edged with whitish and followed by another within. Hind wings pale grayish at the extreme base, followed by a broad median and a terminal band, leaving the space between them very narrow. Head and thorax grayish, the latter brownish gray, with the patagia edged inwardly with black. Abdomen gray black on each side, broken by white on the edges of the segments. Expanse, 3.25-3.60 inches=81-90 mm.

It is possible that this rare species may occur in this vicinity. It is found in Newfoundland, Canada, Maine, northern New York and Ohio. The early stages are unknown.

Sphinx eremitus *Drury.*

Plate VI, Fig. 2.

Fore wings brownish ash color, clouded with darker brown, with a rather heavy short black dash between each vein from beneath the cell to the apex. Discal spot white. From near the base, on the inner margin, are two short, parallel, oblique, black streaks and across the outer portion of the wing is an indistinct transverse, curved band. Hind wings with a black patch at the base and a broad median and terminal border of the same color; spaces between these and the basal spot dirty white. Head and thorax brownish ash, the latter with a black line through the middle of the patagia. Abdomen brownish ash, a median black line and the side alternately black and dirty white. Underside of fore wings grayish brown with faint indications of three transverse bands; hind wings dirty whitish, with the central and terminal band brownish. Expanse, 2.50-3.15 inches=63-79 mm.

Larva.—Head small, brown with a lateral white stripe. Abdominal segments reddish brown with many tan-colored or whitish ocellated spots. Second segment light brown above, olive at the sides; collar light brown outlined with black. The second segment is subtriangularly produced, with the apex rounded, pointing forward, and extending over the head when the larva is at rest; it is olive brown at sides with a velvety brown spot. Third and fourth segments also olive brown with a velvety brown spot on top. Along the sides of the body are seven whitish oblique stripes, bordered with brown posteriorly. Caudal horn brown. Length, 2.25–2.75 inches=56–68 mm.

Pupa.—Chestnut brown; head-case subtriangular; tongue-case exerted, dark brown, nearly straight and slightly raised from the breast by its bulbous end. Length, 1.60 inches=65 mm.

Food-plants.—Spear Mint (*Mentha*), Wild Bergamot (*Monarda*), *Salvia*, etc.

Very rare in this vicinity. It may be recognized by its brown color and the black streaks on the fore wings. Double brooded. The larva may be known by the triangular protuberance on the second segment, differing in this respect from all our Sphinges.

Sphinx plebeius *Fabr.*

PLATE VI, FIG. 3.

Fore wings gray, streaked with black between the veins from the base of the inner margin, thence obliquely to the apex. Discal spot white. Across the outer fourth are traces of transverse lines, but they are very indistinct or absent; before the outer margin are some indistinct shadings of whitish. Hind wings smoky brown with traces of a lighter shade across the middle and base; fringes white, cut with smoky brown. Head and thorax gray, with a black line around the anterior portion and continued along the middle of the patagia. Abdomen gray, with a narrow black dorsal stripe and a broad black stripe along each side containing a row of grayish spots. Underside of wings fuscous. Expanse, 2.65–3 inches=66–75 mm.

Larva.—Body green, paler above, with seven oblique lateral stripes along each side, yellow, edged with black anteriorly. Caudal horn blue, with small black tubercles. Sometimes the larva is olive pink with numerous flesh-colored dots, with the oblique bands olive, and a shade of the same color along the subdorsum; sides of body olivaceous Length, 2.60 inches=65 mm.

Pupa.—Chestnut brown, with the detached tongue-case very straight and closely applied to the breast; and at its base it is very slightly curved and reaches to about the middle of the wing-cases. Length, 1.40 inches=35 mm.

Food-plant.—Trumpet-vine (*Tecoma*).

This species is not rare in this vicinity; especially found in flower gardens about the trumpet-vines. It is double brooded, appearing in June and again latter in July and early in August. Found from Canada to Florida and westward to the Mississippi.

Chlænogramma *Smith.*

Form robust ; head rather large with a small tuft between the antennæ ; eyes moderate, not lashed ; antennæ fusiform, minutely biciliate in the male, simple in the female, slightly curved at the tip ; thorax stout, somewhat produced before the base of the fore wings ; abdomen long, pointed, with a row of loose tufts along the back. Fore wings long, much longer than the body, and rather broad ; outer margin slightly rounded, oblique, and somewhat excavated above the hind angle. Hind wings rounded.

Chlænogramma jasminearum (*Boisduval*).

PLATE VI, FIG. 5.

Fore wings pale gray, finely mixed with brown and blackish scales ; across the basal third are two indistinct wavy lines, and three similar transverse lines beyond the middle, and beyond these is another line less distinct and interrupted ; from the basal line on the costa is a conspicuous blackish shade running obliquely to the middle of the outer margin ; discal spot small, whitish, with a yellowish brown blotch beyond ; fringes white and black. Hind wings brownish black with traces of a very indistinct paler central band. Head, thorax and abdomen gray ; thorax with a blackish transverse line in front extending through the middle of the patagia, hind part with two black spots and two spot-like bands along each side. Underside of wings uniform fuscous, with a slightly darker central band. Expanse, 3.20–4.25 inches=80–105 mm.

Larva.—Pale green, lighter dorsally ; body with six oblique lateral white stripes, and a seventh red stripe which extends to the green caudal horn ; thoracic feet pink ; spiracles white encircled with black. Length, 3 inches=75 mm.

Pupa.—Dark brown, with a very short cylindrical tongue-case, bulbous at the end, and applied to the breast. Length, about 2.50 inches=62 mm.

Food-plants.—Various species of Ash (*Fraxinus*).

This species may be easily known by its gray color and distinct oblique black shade across the fore wings. In this vicinity it is quite rare, and is probably double brooded. It is found from Canada to Georgia. The larva and pupa are imperfectly known.

Ceratomia *Harris.*

Head rather small, with a light tuft between the antennæ ; eyes small, not prominent ; antennæ biciliate in the male, simple in the female ; proboscis reaching the end of the thorax ; thorax short, somewhat advanced in front of the base of the fore wings ; abdomen untufted, tapering. Spurs of middle and posterior tibiæ small. Fore tibiæ with short stout terminal spinules ; anterior tarsi with three claw-like spines on the first joint and one on the second. Fore wings large, much longer than the body, outer margin oblique or slightly rounded. Hind wings with margins entire, and anal angle slightly produced ; apex obtusely rounded.

Ceratomia amyntor (*Hübner*).

PLATE VI, FIG. 6.

Fore wings dark coffee brown ; costal region and outer margin clay brown ; outer portion of costa mixed with gray ; along the middle portion of the wings between and parallel with the veins, below the median vein and beyond the cell, are several heavy black dashes ; at the basal portion of the wings are traces of several wavy transverse lines ; across the outer fourth are several angulated and wavy transverse lines, curved outwardly. Discal spot distinct, whitish. Hind wings clay brown, with a central and subterminal ill-defined band. Head above, collar and front part of thorax whitish ; patagia coffee brown with black lines ; central portion of thorax clay brown ; abdomen clay brown, with a black dorsal stripe and two lateral stripes. Underside of wings brown with grayish scales, fore wings with traces of the outer transverse lines from above repeated ; hind wings with a double transverse zig-zag line. Fringes above and below brown, interrupted with whitish spots. Expanse, 3–4.25 inches=75–106 mm.

Larva.—Pale green, sometimes reddish brown ; head and body strongly granulated, with a dorsal row of short fleshy teeth, tipped with white or pink, these teeth extending from the fourth segment to the caudal horn ; on each of the third and fourth segments is a pair of short, straight tubercles, covered with short spines ; along the sides are seven oblique whitish stripes composed of granulations. Caudal horn green, thicky covered with short spines. Length, 2.75–3.25 inches=68–81 mm.

Pupa.—Chestnut brown ; head small, rounded, slightly depressed ; eye-cases margined inferiorly by an impressed line ; tongue-case buried ; antennæ-cases granulated ; first and second segments with a slightly elevated median line. Abdominal segments punctulate, wrinkled posteriorly ; terminal spine rugose, pointed, minutely bifid. Length, 1.50–2 inches=37–50 mm.

Food-plants.—Various species of Elm, Linden and White Birch.

Rather common in this vicinity in June and July. It may be readily known by its coffee brown and clay brown colors and by the black dashes on the fore wings. The larva may be known by the two fleshy horns on each of the third and fourth segments. Its favorite food is elm. The insect is found from Canada to Virginia, westward to Missouri and Iowa.

Ceratomia undulosa (*Walker*).

PLATE VI, FIG. 7.

Fore wings gray mixed with light brownish scales ; across the basal portion are three angulated transverse black lines, furthest apart on the costa and coming closer together as they reach the inner margin ; these lines are more or less distinct ; from the middle to the outer fourth are four transverse curved lines, the middle two are toothed and the space between them is gray ; from below and beyond the cell, between the veins, are three black dashes and a wavy apical streak ; discal spot white narrowly bordered with black ; fringes alternately brown and white. Hind wings grayish brown, with three ill-defined blackish bands. Head grayish, thorax gray mixed with yellow ; through the middle of the patagia is a black line connected with the one across the anterior portion of the thorax ; across the hind part of the thorax is also a black line edged with yellow and white ; abdomen grayish brown with a black dorsal line and two rows of large black spots along each side. Wings beneath almost uniform grayish brown, hind wings somewhat paler, both wings with two transverse bands ; fringes same as above. Expanse, 2.80–4.60 inches=70–115 mm.

Larva.—Pale green, smooth ; on each side of the body are seven oblique yellowish white stripes ; spiracles pink ; caudal horn pink ; head green with a whitish band on each side. Length, 3 inches=75 mm.

Pupa.—Dark brown ; head-case rugose, rounded, somewhat prominent, and a little compressed laterally ; eye-cases rough, slightly prominent, with a crescent-shaped mark before the middle ; tongue-case concealed ; thorax shagreened ; wing-cases very slightly wrinkled ; abdominal segment deeply punctured, smooth on the junctions ; anal spine short, rugose, pointed. Length, about 1.75 inches=43 mm.

Food-plants.—Lilac, Ash and Privet (*Ligustrum*).

Rather common and double brooded in this vicinity, the first brood appearing in June and the second in August. The ground color of the insect varies somewhat from light to dark gray, and the lines are more or less heavily marked. It is found from Canada to Carolina, and westward to Iowa.

Dolba *Walker*.

Head rather small, roughly scaled, inclining to form a tuft between the antennæ ; palpi roughly scaled ; proboscis longer than the body ; eyes moderate, lashed ; antennæ minutely biciliate in the male, simple in the female, hooked at the end ; thorax stout, as broad as long. Tibiæ not spinulose, middle with one pair, posterior with two pairs of unequal spurs. Fore wings as long as the body, rather broad ; outer margin entire, very slightly excavated above the hind angle. Hind wings broad, apex well rounded, entire, and slightly excavated before the anal angle.

Dolba hylæus (*Drury*).

PLATE VI, FIG. 4.

Fore wings dark rusty brown with three transverse black lines across the basal third, the inner two diffused with white ; across the outer fourth are four dentate black lines, the outer ones with more or less white between them ; terminal space shaded with white, forming no definite pattern. Discal spot small, white. Fringes rusty brown, cut with white. Hind wings smoky brown with two parallel whitish lines across the middle. Fringes white, cut with brown. Head and thorax rusty brown, the latter white at the extreme sides, with black and white on top. Abdomen rusty brown, a dusky broken central line, and a row of small white dots on each side ; laterally the abdomen is black and broken with white on the edges of the segments. Underside of wings smoky brown, with traces of transverse lines across the outer fourth of the fore wings. Hind wings whitish and crossed by several dentate lines, followed by whitish shades. Expanse, 2.20–2.60 inches=50–65 mm.

Larva.—Pea green, with seven oblique lateral whitish bands edged above with pink ; caudal horn purple, and a pale blue stripe on each side of the head. Length, 2.33 inches=58 mm.

Pupa.—Chestnut brown ; tongue-case concealed, straight and closely applied to the breast. Length, 1.60 inches=40 mm. ; tongue-case, .50 inch=12 mm.

Food-plant.—Ink-berry (*Ilex glabra*).

Not common in this vicinity. It may be easily known by its small size and rusty brown color, with the transverse black lines and white shades. In general appearance it resembles a miniature *Phlegethontius rusticus.* It is found from Canada to Florida, and westward to Iowa.

Lapara *Walker.*

Head small, retracted, the scales forming a tuft or ridge between the antennæ ; palpi short, slender, porrect not pointed upwards, and much shorter in the female than in the male ; eyes of medium size, slightly lashed ; proboscis very short ; antennæ biciliate in the male, simple in the female, tip slightly bent ; thorax scarcely advanced in front of the wings, short, stout ; abdomen untufted. Fore wings entire, with outer margin obliquely rounded. Hind wings with apex rounded, outer margin with hind angle somewhat produced.

Lapara coniferarum (*A. & S.*).

PLATE VII, FIG. 1.

Fore wings leaden gray, with a darker, dentate line across the outer fourth, from the costa to the inner margin ; between the veins beneath the cell are two blackish dashes, the lower one being the shortest. Hind wings grayish brown. Head and thorax leaden gray ; abdomen brownish gray. Underside of wings uniform brownish gray. Expanse, 2–2.50 inches=50–62 mm.

Larva.—Yellowish green with three longitudinal, equidistant, white stripes along each side. Head conical, flattened in front, yellowish green with a black line along each side, uniting on the summit. Stigmatal spaces marked with red. Caudal horn wanting. Sometimes the larva is checkered with light and dark-gray squares. Length, 2.25–3 inches=56–75 mm.

Pupa.—Cylindrical, pitchy black. Head, thorax, and anterior margin of wing-covers rugosely punctate, as are also the fore margins of the segments. The four posterior segments are rugosely punctate nearly over their entire surface. Anal spine pointed. Tongue-case concealed. Length, 32 mm.

Food-plants.—Various species of Pines.

This species is somewhat variable. The fore wings are sometimes almost uniformly leaden gray without the two dark dashes, or have only one dash. The insect is quite rare in this neighborhood. Found from Canada to Florida.

Lapara bombycoides var. **harrisii** (*Clem.*).

PLATE VII, FIG. 2.

Fore wings gray, with a pair of dentate lines across the outer fourth from the costa to the inner margin, with the space between light gray, as is also the outer portion of the wings ; before the middle and across the basal fifth are two transverse lines, angulated outwardly above the middle ; beneath the cell are two conspicuous black dashes. The spaces between the lines are more or less shaded with light gray. Hind wings uniform brownish gray ; also the head, thorax, abdomen and tip of the patagia are light gray. Underside of wings uniform gray or brown, sometimes with a dark line across each. Expanse, 2–2.25 inches=50–56 mm.

Larva.—The ornamentation consists of alternate green and white longitudinal stripes. Dorsal stripe green, spotted with red. Head red in front, with a white or pinkish white border. Collar and legs green ; prolegs and last segment bordered with red. Caudal horn absent. Length, 2–2.50 inches=50–62 mm.

Pupa.—Chestnut brown, with a rough, not produced head-case. Tongue-case buried. Posterior segment tapering. Terminal spine black, contracted at base, minutely bifid at tip. Length, 1–1.10 inches=25–27 mm.

Food-plants.—Various species of Pines.

Rare in this neighborhood, and is probably double brooded. Found from Canada to Florida, and westward to the Mississippi. It may be recognized by its small size, gray color, and transverse, dentate and angulated lines.

Synopsis of Species of Sphinginæ.

Dilophonota.

Thorax anteriorly with a short crest divided in the middle; eyes large.

Fore wings light gray or streaked with fuscous; hind wings rust red with black outer border.................... *D. ello.*

Phlegethontius.

Thorax not crested; head and eyes very large; abdomen with yellow or pink spots along each side.

Fore wings light ashen and dark gray, with black lines and streaks; hind wings with two central dentate lines, *P. quinquemaculatus.*

Fore wings dark brownish gray, markings similar to *quinquemaculatus;* hind wings with central lines not dentate, *P. carolina.*

Fore wings dark gray, lines and streaks black; hind wings at base and spots on abdomen pink................ *P. cingulatus.*

Fore wings sooty or rust brown, with black transverse lines and shaded with white.......................... *P. rusticus.*

Sphinx.

Head moderate, eyes small; abdomen black at sides, with spots.

Thorax dark smoky brown, pale grayish at sides.

Fore wings smoky black; costal region whitish.... *S. drupiferarum.*

Fore wings entirely sooty black marked with gray, costal region concolorous. Discal spot white................ *S. gordius.*

Fore wings rust brown; discal spot wanting; hind wings ochre yellow, outer border black...................... *S. lucitiosa.*

Thorax chestnut brown, sides grayish.

Fore wings light and dark chestnut brown, in form of streaks, *S. kalmiæ.*

Thorax dark grayish, sides whitish; patagia with a black line inwardly.

Fore wings gray, with black dashes between the veins.. *S. canadensis.*

Thorax entirely gray; patagia with a black line inwardly.

Fore wings light gray with black dashes................ *S. chersis.*

Thorax ashen brown with black through the patagia; sides pale.

Fore wings ashen brown with black dashes............. *S. eremitus.*

Thorax ashen gray, white at sides; patagia with a broad black line through the middle.

Fore wings gray with black streaks; discal spot white; hind wings black.................................. *S. plebeius.*

Dolba.

Small species: Head roughly scaled, with a tuft between the antennæ.

Fore wings sooty brown or rust brown, with transverse dentate black lines, shaded with white..................... *D hylæus.*

Chlænogramma.

Large species : Eyes large ; abdomen with bunches of raised scales along the dorsum ; legs not spinose.

Fore wings gray mixed with brown, and a black shade from the middle of the costa to the middle of the outer margin, *C. jasminearum.*

Ceratomia.

Large species : Eyes small ; abdomen without dorsal tufts ; legs spinose.

Fore wings coffee brown, paler along costal and outer region, and with black streaks between the veins... .. ...*C. amyntor.*

Fore wings gray, with transverse black lines............*C. undulosa.*

Lapara.

Small species : Head small, retracted ; palpi very small, not ascending.

Fore wings leaden gray, with a transverse black line beyond the middle, sometimes with two short black dashes beneath the cells.......................... ....*L. coniferarum.*

Fore wings gray scaled with white ; two angulated transverse lines before the middle, and two dentate ones beyond, *L. bombycoides* var. *harrisii.*

Subfamily SMERINTHINÆ.

Amorpha *Hübner.*

Large species ; head small, sunken, with a small median crest ; palpi very small, rudimentary ; antennæ strongly biciliate in the male, simple in the female. Thorax stout, not tufted ; abdomen plump, last segment blunt. Middle and hind tibiæ with a single pair of short terminal spines ; anterior with a stout curved spine at the inner side of the tip. Tarsi finely spinose. Fore wings broad, much longer than the body, with the outer border regularly scolloped. Hind wings also scolloped.

Amorpha modesta (*Harris*).

Plate VII, Fig. 7.

Fore wings light mouse gray at the base ; across the middle is a very broad olive gray band ; outer portion of wings olivaceous with lighter transverse shades. Hind wings gray, shaded more or less with claret red through the middle, and at the anal angle a bluish gray patch. Head, thorax and abdomen mouse gray, with a bluish tint. The wings have also a decided bluish reflection. Underside of wings olive gray with pale gray transverse shade ; fore wings more or less claret red towards the base ; sometimes the wings are almost uniform gray. Expanse, 3.50–5.50 inches=88–138 mm.

Larva.—Light green coarsely granulated with white points ; along each side with seven oblique yellow bands, and on each side a yellow subdorsal line ; caudal horn rudimentary ; prolegs red ; spiracles brown ; head green, triangular, granulated. Length, 3 inches=75 mm.

Pupa.—Robust, blackish brown, shagreened, terminal spine short, blunt and flattened horizontally; tongue-case concealed. Length, 1.80-2 inches=45-50 mm.

Food-plants.—Willow and Poplar.

Rather scarce in this vicinity, but more common in the Northern and Western States. It is found from the Atlantic to the Pacific. It varies in depth of the ground color from light to dark, and in the distinctness of the transverse markings. In the Western States the prevailing form of this species is quite pale, and has been named *occidentalis*. In this neighborhood it is found during the latter part of July and August, and is probably double brooded.

Smerinthus *Latreille.*

Head small, sunken, tufted between the antennæ; palpi short, not closely applied to the head; tongue rudimentary; eyes small; antennæ rather strongly pectinate in the male, simple in the female; thorax stout; abdomen more or less tufted at the sides. Fore wings more or less excavated outwardly or scolloped; anal angle produced; inner margin excavated; hind wings rounded, costa straight or excavated; anal angle more or less produced.

Smerinthus geminatus *Say.*

PLATE VII, FIG. 4.

Fore wings ashen gray, or brown with a rosy tinge; across the basal third is an angulated deep brown line, the angle being a little below the middle and pointing outwardly; across the wings are also a number of transverse wavy lines, usually more or less distinct but sometimes quite confluent with the ground color; from the angle of the basal line a velvety brown dash runs outwardly to the transverse roseate or gray line, sometimes filling the lower half of this interspace. The terminal space is light or dark brown, forming a distinct apical lunule. Hind wings rosy red, with buff colored outer borders, which are rarely pink, and a large black spot near the anal angle containing one or two small blue spots. Head and thorax ashen gray or ashen brown, the latter with a deep brown patch occupying the entire space between the patagia. Underside of fore wings rosy red at base, outer half brown with wavy transverse lines; hind wings brown and grayish, powdery, with transverse curved lines. Expanse, 1.80-2.75 inches=45-65 inches.

Larva.—Body green, paler dorsally, with numerous granulations; along each side are seven oblique bands of a pale yellow color except the last, which is bright yellow; on the anterior segments is also a stripe on the subdorsum;

head triangular, green, granulated, with an oblique yellow stripe on each side, meeting at the apex. Caudal horn bluish, granulated; thoracic feet green; spiracles red. Length, 2–2.60 inches=50–56 mm.

Pupa.—Very similar to that of *S. excæcatus*, but smaller.

Food-plants.—Cherry, wild and cultivated, Plum, Apple, Elm, Oak, Hazel, Hornbeam (*Carpinus*), Ironwood (*Ostrya*), Birch, Willow, Poplar, Ash, etc.

Rather common in this vicinity. It is double brooded, the first brood appearing in June and July, and the second in August. The moth is subject to considerable variation from light to dark shades on the fore wings. It also varies in the form of the ocellus of the secondaries. It is found from Canada to Virginia, and westward to Iowa.

Smerinthus excæcatus (*A. & S.*).

Plate VII, Fig. 4.

Fore wings fawn color, with a pinkish tinge and darker shades and markings; the basal third is fawn color with one or two more or less distinct wavy brown lines; beyond this is an oblique dark brown shade running from the costa at the basal fourth to the hind margin near the angle, where it is broken by two or three small black spots. Across the outer fourth are three sinuous lines of the same color as the base of the wing, and in which are two narrow darker lines; outer part of wings dark with a narrow, wavy, light band or shade. Hind wings rose red with a large black spot containing a blue centre. Underside of fore wings rose color, outer portion partly ochreous, with pinkish broken lines. Hind wings ochraceous with pink transverse lines. Head and thorax fawn color, the latter rich velvety brown along the middle; abdomen ochreous above, pinkish fawn color at sides. Expanse, 2–3.80 inches=50–95 mm.

Larva.—Body granulated, apple green, paler above, with oblique, yellow lateral bands and a yellow subdorsal stripe broken by the bands. Head triangular, green with a yellow stripe on each side uniting at the apex, granulated; caudal horn green; thoracic feet reddish brown, bases yellow. Sometimes the body is more or less marked and spotted with red. Length, 2.20 inches=55 mm.

Pupa.—Dark brown; head-case rounded, corrugated; wing-cases smooth; thorax and segments punctured; terminal spine corrugated, and sharply pointed; tongue-case concealed. Length, 1.20–1.80 inches=30–40 mm.

Food-plants.—Wistaria, Cherry, wild and cultivated, Plum, Apple, Pear, Raspberry, Rose, *Spiræa*, Elm, Oak, Hazel, Hornbeam (*Carpinus*), Ironwood (*Ostrya*), Birch, Willow, Poplar, Ash, etc.

Common in this neighborhood, and is double brooded, appearing in June and July and again in August. The moth is very variable in color; sometimes the males are very much darker with an olivaceous shade, tinged with purplish. It is found throughout the eastern United States and Canada. It may be easily recognized by having the outer edge of the fore wings regularly scolloped, and by the rose-colored hind wings with the eye-like spot.

Smerinthus myops (*A. & S.*).

PLATE VII, FIG. 5.

Fore wings rich brown with a lilac wavy line across the basal third and several across the outer fourth; on the costa before the apex is a small yellow patch, and another before the anal angle; sometimes these two patches almost run across the wing in shape of a band between the lilac lines. Head, thorax and abdomen light or dark brown, thorax yellowish along the middle. Hind wings yellow bordered with brown along the costa and outer border; in the yellow area is a large black spot with a blue centre. Underside of wings yellow, more or less marked with brown, and with the lilac outer lines of the fore wings partly repeated; across the hind wings are two or three wavy, lilac lines. Expanse, 2–2.50 inches=50–62 mm.

Larva.—Green, not granulated, with seven yellow oblique lateral bands, and one on each side of the head; along each side of the back a row of red spots and another row near the spiracles; caudal horn green. Length, 2 inches= 50 mm.

Pupa.—Same shape as that of *S. excæcatus*, but smaller and less stout. Length, 1.20 inches=30 mm.

Food-plants.—Wild and cultivated Cherry.

Rare in this neighborhood; found during June and July. It is probably double brooded. The moth may be easily known by the deep brown upper wings and yellow hind wings with the black eye-like spot. The larva very much resembles that of *S. excæcatus*, but is smooth instead of granulated. It is found from Canada to Florida, and west to the Mississippi.

Smerinthus astylus (*Drury*).

PLATE VII, FIG. 6.

Fore wings ochraceous brown with lighter and darker shades ; across the wings, from near the base to the inner margin near the angle, is a dark oblique line ; along the inner margin, beyond the base, runs a black shade terminating on a yellowish brown spot before the hind angle ; across the terminal space is a lilac line ; on the costa before the apex is a subtriangular orange ochreous patch from which runs a darker shade, losing itself in the ground color about the middle of the wing ; before the costal patch are two short lilac lines. Hind wings paler than the fore wings, containing a round black spot with a bluish centre. Head and thorax with a lilac tinge, the latter ochreous brown along the middle ; abdomen lilaceous with a yellowish ochreous shade along each side of the back, and a darker dorsal line more or less distinct. Underside of wings ochreous, outer portion darker ; on the fore wings the lilac lines from above are repeated, as are also the orange ochraceous patches, the one near the hind angle much the larger ; hind wings with two transverse lilac lines across the middle followed by a bright orange ochraceous band, terminal space dark. Expanse, 2–2.50 inches=50–62 mm.

Larva.—Yellowish green ; yellowish along the dorsal region ; head broadly marked with pink on each side, this color uniting at the apex ; on the first to the end of the second segment is a pink subdorsal stripe ; on each side of the body are seven oblique, broad yellow bands, which are broadly marked anteriorly with pink on the dorsal region ; spiracles in a pink patch ; thoracic feet pink ; abdominal and anal legs pinkish outside ; caudal horn pinkish at base, tip yellow and minutely forked ; head and body covered with small white granulations. Length, 2 inches=50 mm.

Food-plants.—Various species of Huckleberry and Rosaceæ.

This rare species may be distinguished from its congeners by its plain color and markings. The life history is imperfectly known. It is found from Canada to Pennsylvania, and probably also southward and westward.

Cressonia *G. & R.*

Head small, sunken, with a ridge in front ; palpi in the male long and exceeding the vertex, not closely applied to the head, separated and divaricate at the tip ; in the female the palpi are much shorter ; tongue rudimentary ; antennæ of male strongly bipectinate, simple in the female ; thorax short and stout, slightly crested along the middle ; abdomen of male tapering, with tufts along each side in form of dentations, hardly visible in the female. Fore wings as long as the body in the male, longer in the female, broad, outer margin dentate, inner margin sinuate. Hind wings rounded, dentate outwardly.

Cressonia juglandis (*A. & S.*).

PLATE VII, FIG. 8.

Fore wings pale fawn color, sometimes with a pinkish tint, or sometimes with light or dark brown shades between the transverse markings and outer portion of the wings; across the basal fourth is a narrow brown line, and another across the basal third; across the outer fourth are also two parallel transverse lines, curved at the costa and running to the hind margin, the inner line ending near the middle of the wing; before the inner line is sometimes a transverse shade in form of a line. Hind wings with two or three lines across the middle. Head, thorax and abdomen pale fawn color, thorax light or dark brown along the middle. Undersides light or dark ochraceous with the outer transverse line from above on the fore wings repeated; hind wings with lines same as above. Expanse, 2–3.20 inches=50–80 mm.

Larva.—Green or brown; head triangular, apex quite pointed and bifid, much more so than in the larvæ of *Smerinthus*, with white granulations; body elongated, tapering gradually from the seventh segment to the extremity, granulated with white; along each side are seven light green or whitish oblique bands, composed of granules; caudal horn brownish, covered with black spinules. Sometimes the body is spotted with pink. Length, 2.50 inches=63 mm.

Pupa.—Dark brown, almost black, rough, covered with short points; head-case with four projections and also one on each eye-case; antennæ-cases with a row of short pointed spines; tongue-case buried; last segments very much flattened beneath and compressed laterally; anal segment with a flat, truncate projection; last few segments encircled with rows of short spines. Length, 1.20–1.50 inches=30–43 mm.

Food-plants.—Hickory, Walnut and Ironwood (*Ostryia*).

Not rare, and double brooded in this vicinity. The first brood appears in June and the second in August. The species is subject to considerable variation; some specimens are uniformly pale fawn color or ochraceous, with the transverse lines distinct, while other examples are more or less covered with dark brown so as to almost obscure the ground color and transverse lines. It is found from Canada to Florida, westward to the Mississippi and Texas. The larva may be known by its triangular head with the apex pointed and bifid.

Synopsis of Species of Smerinthinæ.

Amorpha.

Large species: Outer margin of fore wings regularly scolloped; abdomen obtuse at apex.

Fore wings pale gray, with a very broad olive gray median band; hind wings shaded with claret red.............................*A. modesta.*

Smerinthus.

Head small, sunken, tufted between the antennæ; fore wings scolloped or more or less excavated. Hind wings with an eye-like spot.

Fore wings scolloped, fawn color with darker shades; hind wings pink...*S. excæcatus.*

Fore wings excavate; gray with dark brown markings; hind wings pink in the middle..................................*S. geminatus.*

Fore wings less excavate than in *geminatus*, dark chocolate brown; hind wings yellow centrally...............................*S. myops.*

Fore wings with outer margin almost entirely straight; color almost uniform ochre brown......................................*S. astylus.*

Cressonia.

Wings broad, outer margin dentate; palpi of male long, ascending, and divaricate at tip; very short in the female; hind wings without eye-like spots.

Pale fawn color, sometimes shaded more or less with dark brown, with narrow transverse lines...........................*C. juglandis.*

EXPLANATION OF PLATES.

Plate II.

Fig. 1.—*Hemaris thysbe* (Fabr.).
Fig. 2.— " " var. *uniformis* (G. & R.).
Fig. 3.— " *gracilis* (G. & R.).
Fig. 4.— " *diffinis* (Bdv.).
Fig. 5.—*Amphion nessus* (Cramer).
Fig. 6.—*Sphecodina abbotii* (Swains.).
Fig. 7.—*Deidamia inscripta* (Harris).
Fig. 8.—*Everyx chœrilus* (Cramer).
Fig. 9.— " *myron* (Cramer).
Fig. 10.— " *versicolor* (Harris).

Plate III.

Fig. 1.—*Aëllopos fadus* (Cramer).
Fig. 2.—*Deilephila lineata* (Fabr.).
Fig. 3.— " *galii* (Rott.).
Fig. 4.—*Therctra tersa* (Linn.).
Fig. 5.—*Pholus pandorus* (Hübn.).
Fig. 6.— " *achemon* (Dru.).
Fig. 7.— " *vitis* (Linn.).

Plate IV.

Fig. 1.—*Dilophonota ello* (Linn.). Male.
Fig. 2.— " " " Female.
Fig. 3.—*Phlegethontius quinquemaculatus* (Haw.).
Fig. 4.— " *carolina* (Linn.).
Fig. 5.— " *cingulatus* (Fabr.).
Fig. 6.— " *rusticus* (Fabr.).

Plate V.

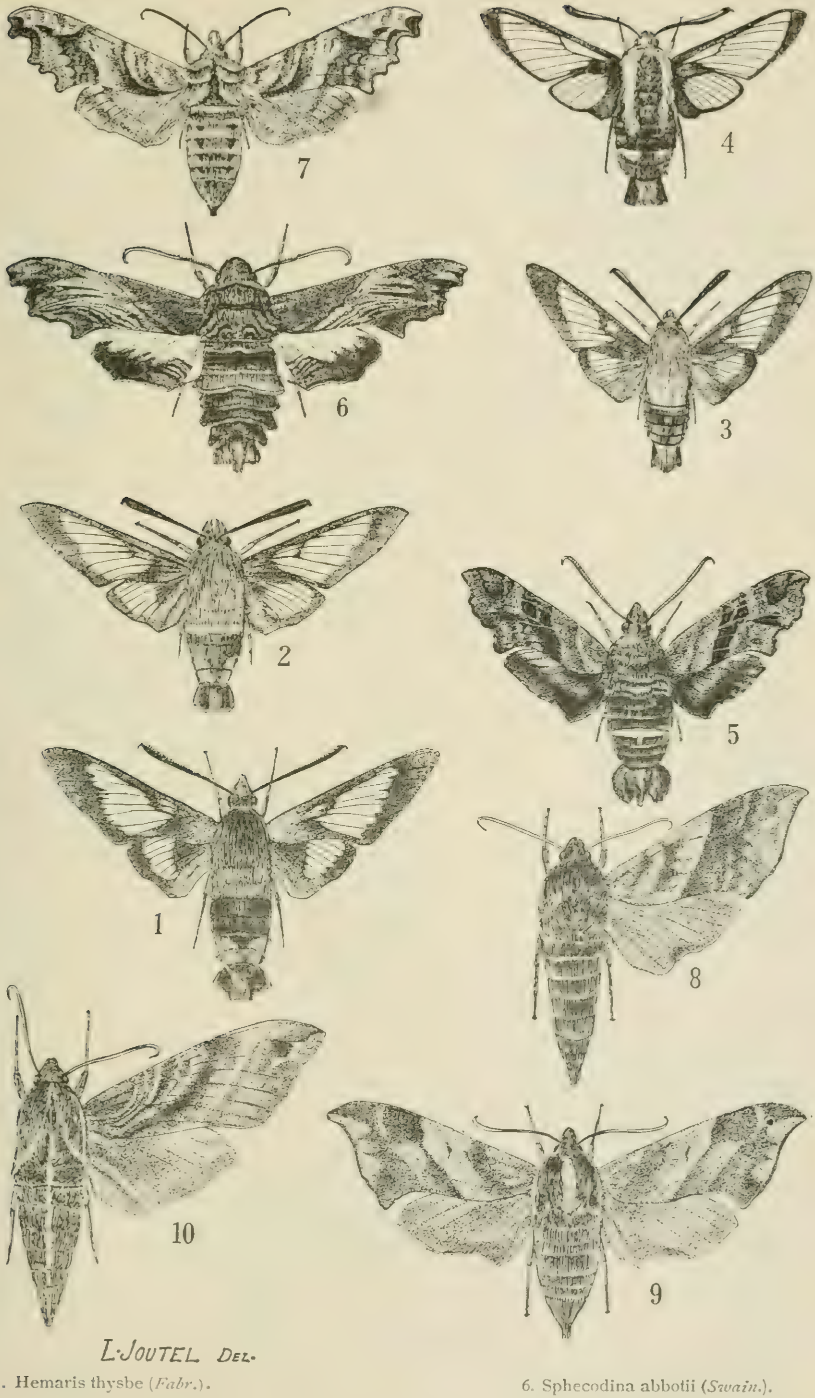
Fig. 1.—*Sphinx drupiferarum* A. & S.
Fig. 2.— " *kalmiæ* A. & S.
Fig. 3.— " *lucitiosa* Cramer.
Fig. 4.— " *gordius* Cramer.
Fig. 5.— " *chersis* Hübn.
Fig. 6.—*Argeus labruscæ* (Linn.).

PLATE VI.

Fig. 1.—*Sphinx canadensis* Bdv.
Fig. 2.— " *eremitus* (Hübn.).
Fig. 3.— " *plebeius* Fabr.
Fig. 4.—*Dolba hylæus* (Dru.).
Fig. 5.—*Chlænogramma jasminearum* (Bdv.).
Fig. 6.—*Ceratomia amyntor* (Hübn.).
Fig. 7.— " *undulosa* (Walker).

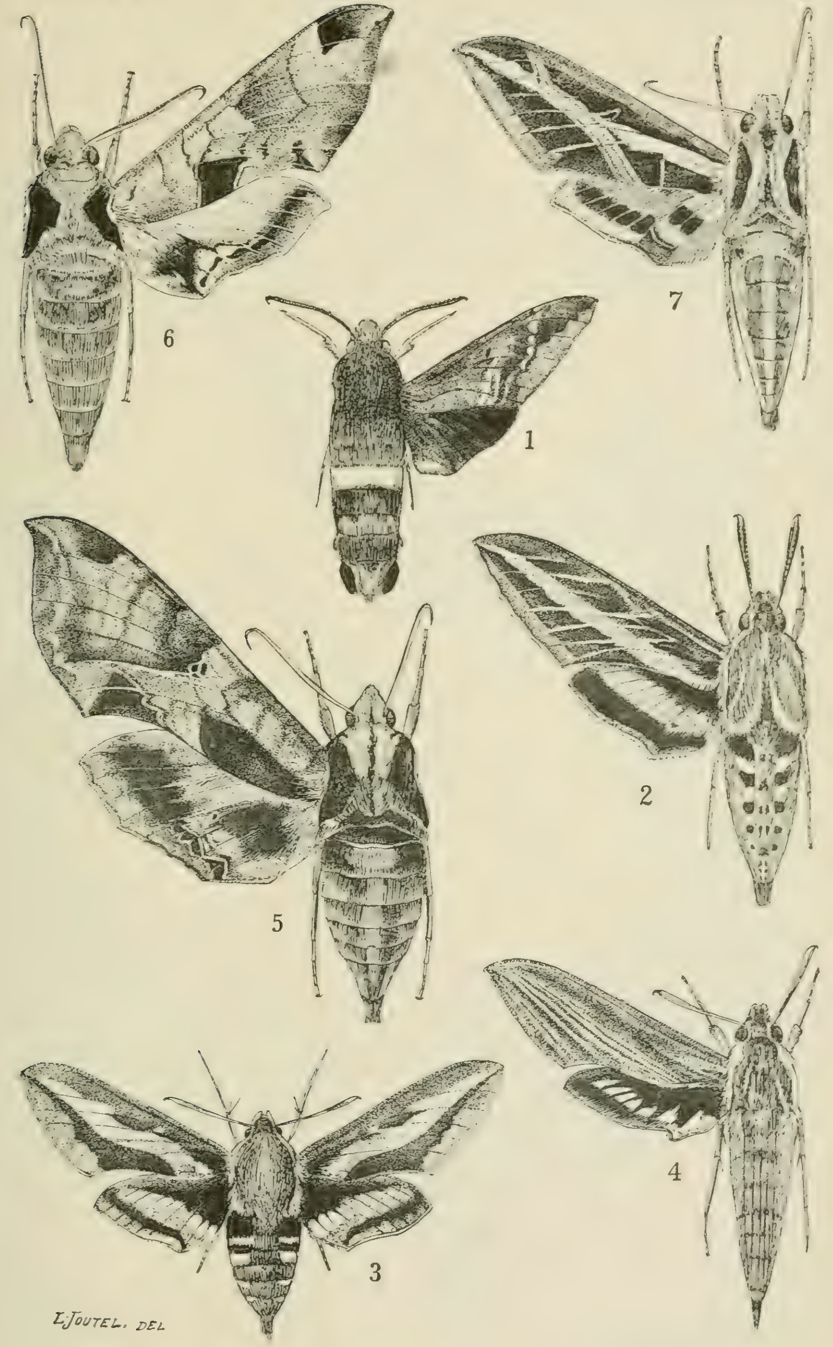
PLATE VII.

Fig. 1.—*Lapara coniferarum* (A. & S.).
Fig. 2.— " *bombycoides*, var. *harrisii* (Clem.).
Fig. 3.—*Smerinthus geminatus* Say.
Fig. 4.— " *excæcatus* (A. & S.).
Fig. 5.— " *myops* (A. & S.).
Fig. 6.— " *astylus* (Dru.).
Fig. 7.—*Amorpha modesta* (Harris).
Fig. 8.—*Cressonia juglandis* G. & R.



L·JOUTEL DEL.

1. Hemaris thysbe (*Fabr.*).
2. “ “ var uniformis (*G. & R.*).
3. “ gracilis (*G. & R.*).
4. “ diffinis (*Bdv.*).
5. Amphion nessus (*Cram.*).
6. Sphecodina abbotii (*Swain.*).
7. Deidamia inscripta (*Harris*).
8. Everyx chœrilus (*Cramer*).
9. “ myron (*Cramer*).
10. “ versicolor (*Harris*).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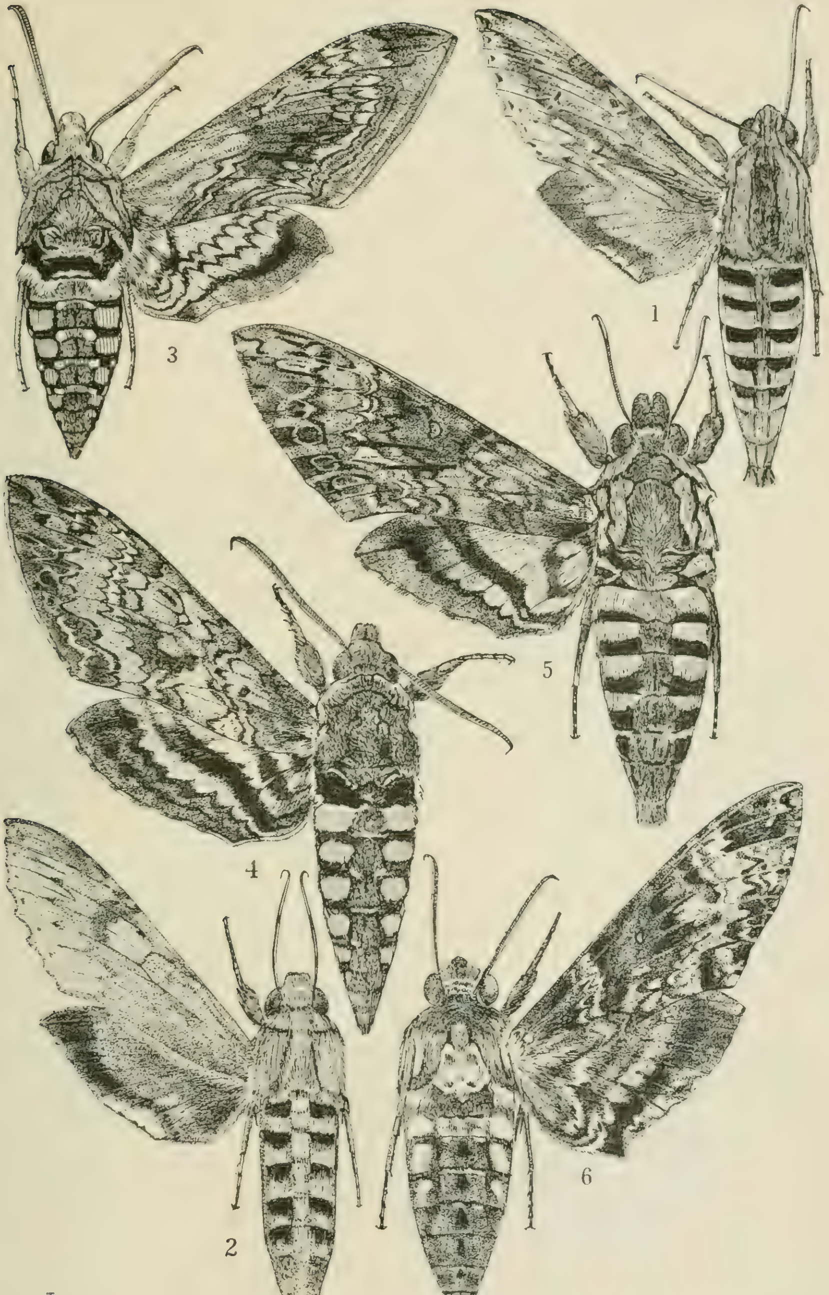
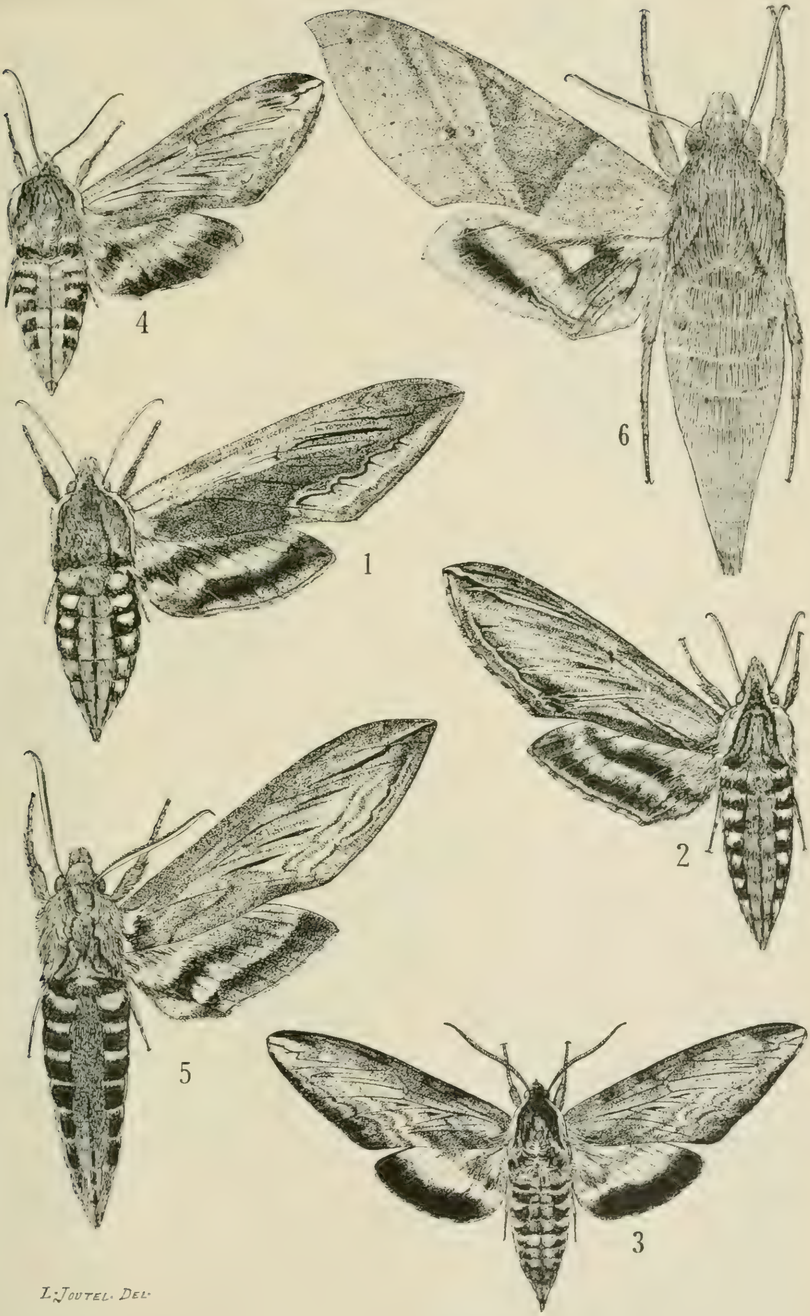
L. Joutel, del

1. Aëllopos fadus (*Cramer*).
2. Deilephila lineata (*Fabr.*).
3. " galii var. INTERMEDIA (*Kby.*).
4. Theretra tersa (*Linn.*).
5. Pholus pandorus (*Hüb.*).
6. " achemon (*Dru.*).
7. " vitis (*Linn.*).



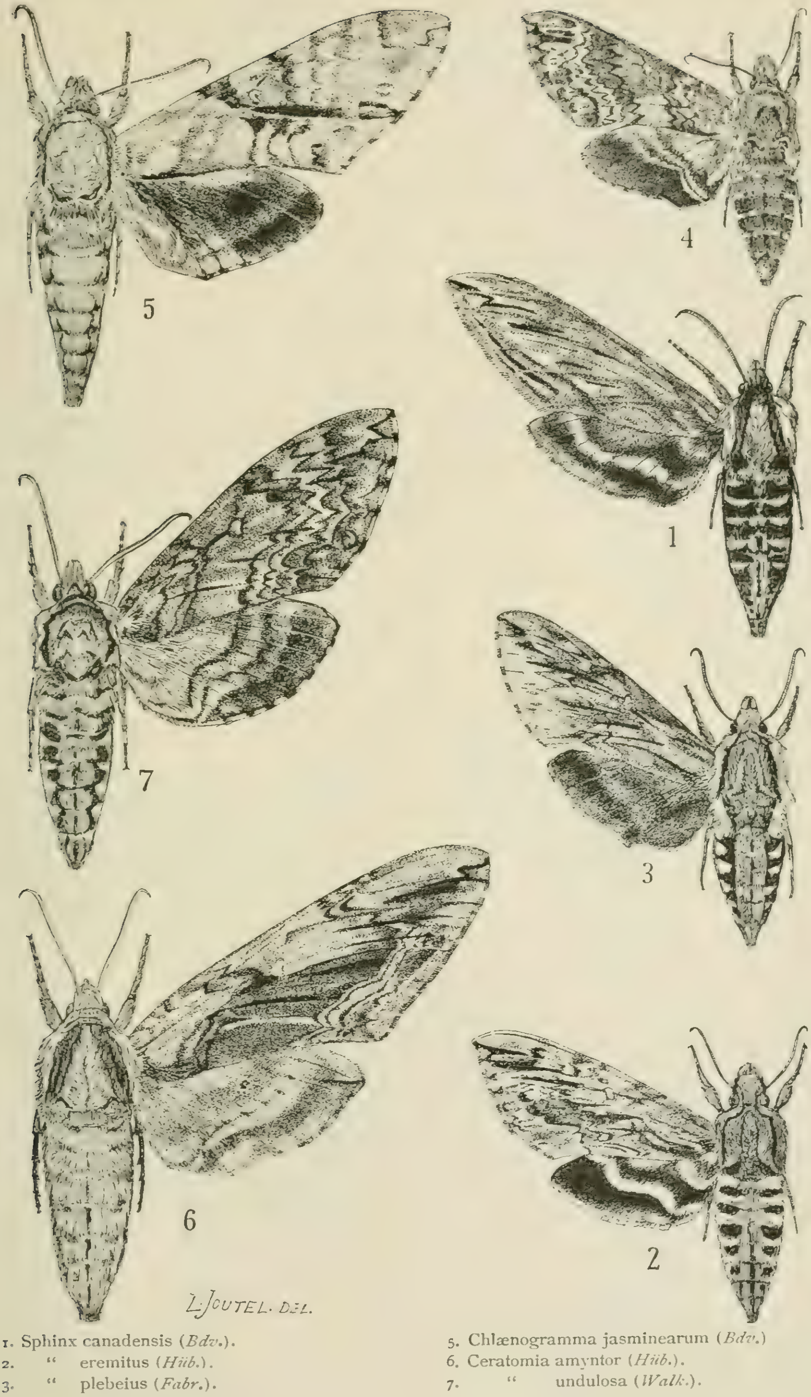
L. JOUTEL. DEL.

1. Dilophonota ello (*Linn.*).
2. " " (female).
3. Phlegethontius quinquemaculatus (*Haw.*).
4. Phlegethontius carolina (*Linn.*).
5. " cingulatus (*Fabr.*).
6. " rusticus (*Fabr.*).



L. Joutel. Del.

1. Sphinx drupiferarum (*A. & S.*).
2. " kalmiæ (*A. & S.*).
3. " lucitiosa (*Cramer*).
4. Sphinx gordius (*Cramer*).
5. " chersis (*Hübn.*).
6. Argeus labruscæ (*Linn.*).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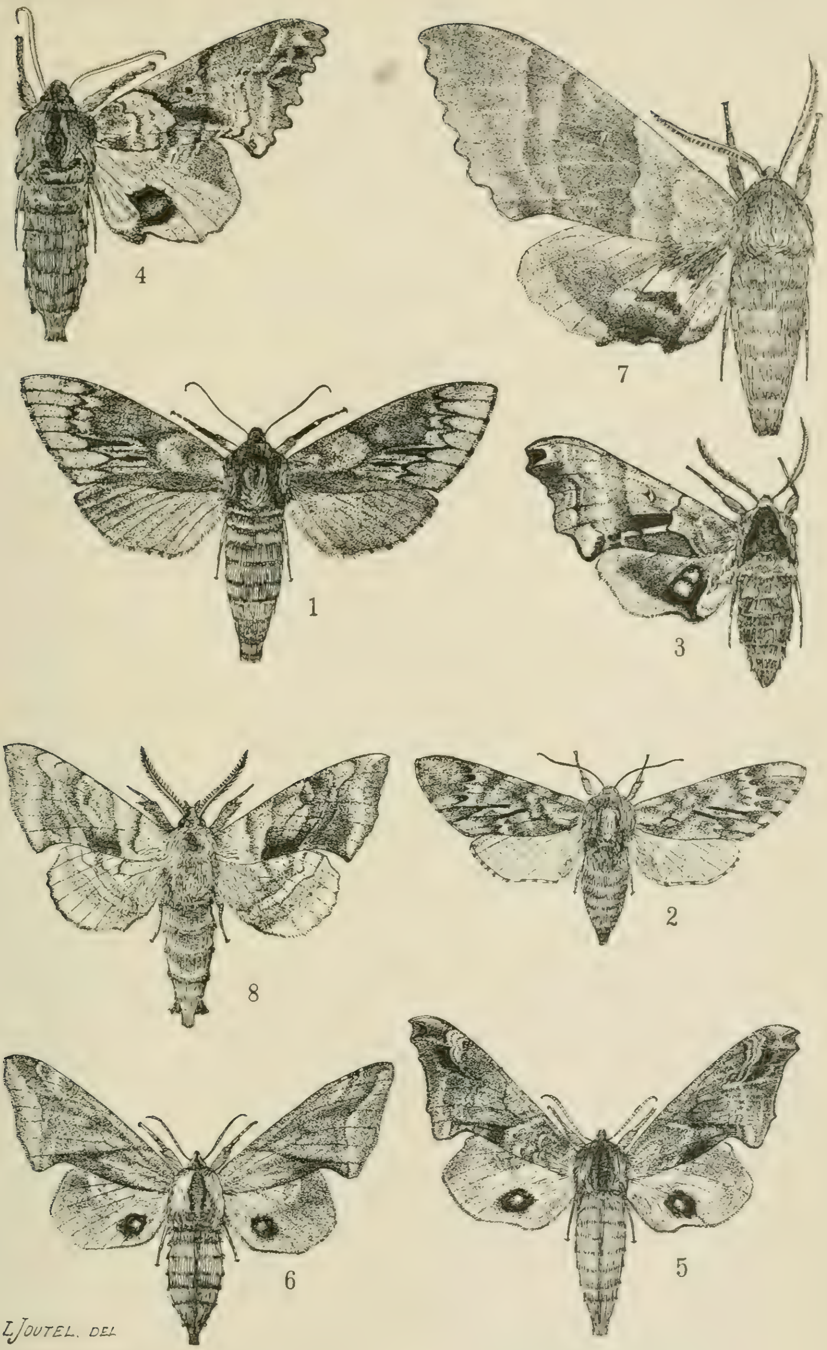
L. JOUTEL. DEL.

1. Sphinx canadensis (*Bdv.*).
2. " eremitus (*Hüb.*).
3. " plebeius (*Fabr.*).
4. Dolba hylæus (*Dru*).
5. Chlænogramma jasminearum (*Bdv.*)
6. Ceratomia amyntor (*Hüb.*).
7. " undulosa (*Walk.*).



L. JOUTEL. DEL

1. Lapara coniferarum (*A. & S.*).
2. " bombycoides var. harrisii (*Clem.*).
3. Smerinthus geminatus (*Say*).
4. " excæcatus (*A. & S.*).
5. Smerinthus myops (*A. & S.*).
6. " astylus (*Dru.*).
7. Amorpha modesta (*Harris*).
8. Cressonia juglandis (*G. & R.*).

Article IX.—FURTHER NOTES ON TRINIDAD BIRDS, WITH A DESCRIPTION OF A NEW SPECIES OF SYNALLAXIS.

By Frank M. Chapman.

A second visit to Trinidad during March and April, 1894, while made largely for the purpose of collecting mammals, resulted in the acquisition of notes on birds which supplement those published in the preceding volume of this Bulletin.[1] On this occasion I was accompanied by Mr. William Brewster, and after a brief visit to my former headquarters near Princestown, we became the guests of Mr. Albert B. Carr, on his cacao estate at Caparo, in the west-central part of the island, seven miles east of Chaguanas. The country here is not unlike that about the rest-house where previous collections were made, the primeval forest being broken only by cacao estates. These, however, are younger and smaller, the region having been settled within comparatively recent years. Probably for this reason certain birds, which are common in the clearings and cacao groves about the rest-house, are as yet comparatively rare or wanting on Mr. Carr's estate; for example: *Vireo chivi agilis*, *Ramphocelus jacapa magnirostris*, *Elainea pagana*, *Pitangus sulphuratus*, and *Tyrannus melancholicus satrapa*.

The month of April was passed in the mountains which form the northern coast of the island. On their northern or seaward side the bases of these mountains are indented by but few bays; on their southern side, however, they are penetrated by numerous valleys. Our home was near the head of one of the most beautiful of these—the Caura Valley—about seven miles from its opening on the plains. Here we were the guests of Mr. J. E. Lickfold.

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[1] 'On the Birds of the Island of Trinidad,' Bull. Am. Mus. Nat. Hist., VI, 1894, pp. 1–86.

Mr. Lickfold's house is at an elevation of 500 feet, while the crests of the surrounding hills reach an average altitude of about 2000 feet. The locality has long been devoted to cacao growing, and the primeval forest has largely disappeared. Still there are many large tracts of first-growth timber within a few hours' ride. While I visited them on several occasions, my experience was too limited to render valuable a comparison of the avifauna of the mountains with that of the lowlands; and I leave to future observers the task of explaining the rarity of such common lowland birds as *Glaucis hirsutus*, *Pygmornis longuemareus*, *Phaëthornis guyi*, *Galbula ruficauda*, *Rhamphastos vitellinus*, and *Pionus menstruus;* while the following equally common lowland species were not once observed: *Ostinops decumanus*, *Cassicus persicus*, *Pipra auricapilla*, *Momotus swainsoni*, *Trogon* (three species), *Amazona*, and *Urochroma*. On the other hand, *Euphonia trinitatis* and *Calliste desmaresti* were observed only in the mountains.

In attempting to express my appreciation of the hospitality extended me, I am again impressed by the failure of words to convey a sense of either my indebtedness or gratitude. Mr. Carr and Mr. Lickfold not only placed their homes at our disposal, but assisted us in every possible manner. I am also under many obligations to Mr. F. W. Urich.

NOTES ON SPECIES NOT OBSERVED IN 1893.

Merula phæopyga (*Cab.*). WHITE-THROATED THRUSH.—One female was taken at Caparo and another at Caura. They agree in color with a Venezuelan specimen.

Euphonia trinitatis (*Strickl.*). CRAVAT.—Not uncommon in the mountains, but not observed in the lowlands.

Calliste desmaresti *Gray.* WORTHLESS.—Observed only on the crests of the ridges in the Caura district, where it was not uncommon.

Piranga hæmalea *S. & G.* RUFOUS TANAGER.—A male in the plumage of the female, but with testes measuring about .18 in their longer diameter, was taken at Caura April 21.

Legatus albicollis (*Vieill.*). BLACK-BANDED PETCHARY.—A male of this species, heard calling from a tree-top, was taken at Caparo.

Chasmorhynchus variegatus (*Gm.*). BELL-BIRD; CAMPAÑERO.—This bird was not uncommon in the forests at Caparo, and in the more heavily wooded districts of the Caura Valley I have heard three birds calling at one time. The notes of this species will be found described at length in an article by Mr. Brewster and myself in 'The Auk' for July, 1895.

Synallaxis carri, sp. nov.

Synallaxis cinerascens LÉOTAUD, *nec* TEMM.

Char. Sp.—Similar to *Synallaxis terrestris* Jard., but upper parts, wings, and tail darker, throat blacker, rest of underparts darker and more olivaceous.

Description of Type (Coll. Am. Mus., No. 60,614, male, Caparo, Trinidad, March 27, 1894; Frank M. Chapman).—Upper parts mummy-brown;[1] exposed portion of the wing-quills and wing-coverts deep chestnut-rufous, tail decidedly darker; central third of the feathers of the upper throat white, lateral third black; feathers of the lower throat centrally buffy; rest of the underparts bistre with a slight cinnamon tinge, the breast faintly streaked with cinnamon. Wing, 2.08; tail, 2.52; exposed culmen, .53 inch.

The differences between this bird and a specimen of *S. terrestris* from Tobago are found in its darker coloration throughout, and especially in the restriction of the white of the throat. In this character it resembles the Colombian *S. læmosticta*, from which species it may, however, be distinguished at a glance by its more olivaceous and less rufous color.

The only specimen secured was killed on the ground in the forests at Caparo.

It gives me pleasure to dedicate this species to Mr. Albert B. Carr, of Trinidad, not only as a token of my gratitude for his assistance, but also in recognition of his knowledge of the Trinidad fauna.

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[1] *Cf.* Ridgway's Nomenclature of Colors.

Chætura cinereicauda (*Cass.*).—A common species at Caparo, where four species of this genus were more or less abundant—the present, *C. cinereiventris lawrencei*, *C. spinicauda*, and *C. polioura*. Frequently all four would be circling above us at the same time. *C. cinereicauda* has not been before recorded from Trinidad, and this capture extends its known range from Southern Brazil. I have no other specimens of *C. cinereicauda* for comparison, but my eight specimens differ from six Yucatan examples of *C. gaumeri* as stated by Mr. Hartert (Cat. Birds Brit. Mus., XVI, p. 482).

Lurocalis semitorquatus (*Gm.*).—Two birds of this species were procured at Caparo. They were observed more or less regularly feeding at dusk near the border of the forest, flying swiftly back and forth over a short circuit and within ten feet of the ground. They thus resembled both a Nighthawk and Whip-poor-will in their feeding habits. A single low, insignificant note, uttered in flight, was the only one heard.

Celeus elegans (*Müll.*). Yellow-headed Woodpecker.—One of two birds seen at Caparo was secured.

Falco rufigularis *Daud.* Red-throated Falcon.—A specimen was taken by Mr. Brewster.

Cancroma cochlearia *Linn.* Boat-bill.—One immature specimen, in rufous plumage, was killed by Mr. Carr.

Additional Notes on Birds Observed in 1893.

Thamnophilus major albicrissus (*Ridgw.*).

Thamnophilus albicrissus Ridgw. Proc. U. S. N. M. XIV, 1891, p. 481.
Thamnophilus major Chapm. Bull. A. M. N. H. VI, 1894, p. 49.

In reviewing my paper on Trinidad Birds,[1] Mr. Ridgway speaks of the "Omission of *Formicarius* [*lege Thamnophilus*]

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[1] Auk, XI, 1894, p. 172.

trinitatis and *F.* [*lege T.*] *albicrissus* described by me in the Proceedings of the U. S. National Museum, Vol. XIV, No. 871, p. 481." These birds were not omitted, but having overlooked Mr. Ridgway's separation of them, I included them both under the names of the Continental forms. At my request Mr. Ridgway has kindly loaned me the two specimens upon which his descriptions were based. Comparison of the type of *Thamnophilus albicrissus* with seven males from Trinidad and twenty males of true *T. major* from Brazil, apparently proves the Trinidad bird to be a race of the latter distinguished by its larger bill, whiter underparts, narrower white edgings on the outer vane of the primaries, and narrower white bars on the rectrices. The character of "remiges entirely without white edgings," given by Mr. Ridgway, appears to be a variable one, dependent probably upon age. Immature specimens with brown wing-coverts, like the type, have no white on the primaries, but fully adult examples have well-developed margins to these feathers.

A male from El Pilar, Venezuela, and also one from British Guiana, agree with Trinidad specimens, and it is probable that all birds from north of the Amazon should stand as *Thamnophilus major albicrissus* (Ridgw.).

Thamnophilus cirrhatus (*Gm.*).

Thamnophilus trinitatis Ridgw. Proc. U. S. N. M. XIV, 1891, p. 481.

As stated above, Mr. Ridgway has also loaned me his type of *Thamnophilus trinitatis.* The characters assigned to this race prove evidently, in my opinion, to be due largely if not entirely to individual variation. Two of three Trinidad specimens have the back of the same color as Mr. Ridgway's type, while the third agrees in coloration with a Demararan specimen. The color of the underparts is also variable. Trinidad specimens may *average* darker below, but a specimen from Demarara is fully as dark, if not darker, than one from Trinidad.

Phaëthornis guyi (*Less.*). Brin-blanc. — Notes on the song-habits of this species, by Mr. Brewster and myself, may be found in 'The Auk' for July, 1895, p. 207.

Nyctibius jamaicensis (*Gm.*). POOR-ME-ONE.—In the paper just cited (p. 208), our experience with this species is given in detail, and also an admirable colored plate. As surmised, *Nyctibius* proved to be the author of the 'Poor-me-one' call generally attributed to the Little Ant-eater (*Cyclothurus didactylus*).

Article X. — DESCRIPTIONS OF NEW AMERICAN MAMMALS.

By J. A. Allen.

During the last few months the Museum has acquired several quite important collections of mammals, which will later form the basis of special papers. As several months will elapse before their publication, it seems advisable to publish in advance descriptions of the several forms contained in these collections which appear to be new.

Lepus aquaticus attwateri, subsp. nov.

Attwater's Swamp Hare.

Type, No. $\frac{7744}{6131}$, ♀ ad., Medina River, 18 miles south of San Antonio, Texas, May 8, 1894; H. P. Attwater.—Above pale buffy gray, heavily lined with black, paler on the sides, which are whitish gray with a faint tinge of buff; median dorsal area more strongly tinged with yellowish, increasing slightly in intensity on the rump; nuchal patch, the fulvous ocular region, the pectoral band, and the outer surface of fore and hind limbs many shades paler than in *L. aquaticus;* ventral surface and inside of fore and hind limbs white, the fur ashy plumbeous basally.

Measurements (from the fresh specimen by the collector).—"Nose to end of tail, 520; tail [to end of hairs], 83; hind foot, 105. Weight, 5¼ lbs. Contained 3 large embryos." Ear from notch (measured from skin), 65.

Skull.—Total length (from posterior edge of occipital crest to front edge of nasals), 87; basal length (posterior border of occipital condyles to front of intermaxillaries), 79; zygomatic breadth, 40; mastoid breadth, 32; least interorbital breadth, 32; length of nasals, 35; greatest posterior breadth of nasals, 18; length of lower jaw, 63; height at coronoid process, 37.

In a former paper on Texas mammals (this Bulletin, VI, 1894, p. 171) reference was made to two specimens of an aquatic hare collected at San Antonio by Mr. Attwater, which on comparison with specimens from Louisiana and the coast of Texas (Matagorda Bay region) proved to be much lighter colored than the latter. Mr. Attwater has since sent four others, making a series of six, taken as follows: one in March, three in April, one in May, and one in June. On comparison with a strictly comparable series from the vicinity of Lake Catharine, Louisiana, the contrast in color is very striking, the San Antonio specimens being many shades paler throughout, lacking almost entirely the rich rusty fulvous tint of the Gulf Coast specimens. This is shown quite as strongly in a young specimen, apparently not more than three weeks old, as in the adults. Fortunately there is a specimen of nearly the same age in the Louisiana series, so that both young and adults of the two forms are available for comparison. In short, the difference between *L. aquaticus* and *L. a. attwateri* is quite as strong as between the Atlantic coast forms of the *L. sylvaticus* group and their representatives in the arid interior.

I take pleasure in naming this strongly marked subspecies in honor of Mr. H. P. Attwater, in recognition of his intelligent and persistent efforts to extend our knowledge of the mammal fauna of Texas. His experience with this inland form of Swamp Hare is detailed in the following note.

"Swamp Rabbits are becoming very scarce, being much less numerous than they were ten years ago. Those I have met with were found in the drift piles and old fallen tree-tops in the most tangled parts of the San Antonio and Medina river bottoms. When frightened from their hiding places and chased by dogs they take refuge in hollow trees and in holes in the river bluffs. The dogs seem to have more difficulty in trailing them than they do the Cottontails and Jack Rabbits, the Swamp Rabbits often eluding the hounds by taking to water. I have seen them on several occasions swimming across the river while the dogs were hunting for them on the other side. I have not heard of their occurrence north of San Antonio, and Mr. Lacey has not met with them on the Guadalupe River in Kerr County."

Reithrodontomys australis, sp. nov.

IRAZÚ HARVEST MOUSE.

Very similar in coloration and proportions to adults of *Reithrodontomys longicauda* in winter pelage from California, but larger.

Adult.—(Type.) Above warm yellowish brown, sparingly lined with black, darker medially and lighter and more yellowish on the sides, but without a distinct fulvous lateral line ; beneath ashy plumbeous with a faint wash of buff, giving the effect of soiled ashy plumbeous, the fur being plumbeous at base. Feet grayish ; ears blackish, well haired ; tail sharply bicolor, dusky brown above, whitish below, quite hairy, but the annuli not wholly concealed.

Total length (measurements from skin), 158 ; tail vertebræ, 80 ; hind foot, 18 ; ear from crown, 10.

Skull.—Total length, 23 ; basal length, 20 ; greatest cranial breadth, 11 ; greatest zygomatic breadth, 10 ; least interorbital breadth, 3.7 ; length of nasals, 8.

Type, No. $\frac{11291}{9555}$, ad., Volcan de Irazú, Costa Rica, June, 1892 ; George K. Cherrie.

This species is based on a single specimen (sex not indicated), received from Mr. A. Alfaro, labeled as above. In coloration and in general external features it bears a surprising similarity to *R. longicauda.*

In this connection it is of interest to recall Mr. Tomes's record (P. Z. S., 1861, p. 284) of '*Reithrodon longicauda*' from Dueñas, Guatemala.

Among other interesting mammals received from Mr. Alfaro, and by him kindly presented to the Museum, may be mentioned a good series of *Geomys cherriei* Allen[1] (this Bulletin, V, 1893, p. 337), described originally from a single specimen, which show that the white crown spot is a constant and normal character. He has also sent a single specimen of *Echimys semispinosus* Tomes (P. Z. S., 1860, p. 265), described from Ecuador, but since recorded from Nicaragua and Costa Rica (Pacuare) by Mr. F. W. True (Proc. U. S. Nat. Mus., 1888, p. 467). The specimen is labeled "'Suerre,' Costa Rica, alt. 1500 ft., July, 1895. A. Alfaro."

Oryzomys cherriei, sp. nov.

CHERRIE'S COTTON RAT.

Pelage rather coarse ; size medium ; tail rather short, considerably less than half the total length.

Adult.—Above yellowish brown, varied with blackish tipped hairs, darkest along the middle of the back, lighter and grayer on the sides ; below whitish gray, the fur dusky at base and tipped with whitish. The color of the lower surface passes gradually into the grayish brown of the flanks. Feet and ears gray; tail nearly naked, indistinctly bicolor—dusky brown above, lighter, grayish brown below.

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[1] *Macrogeomys cherriei* Merriam, N. Am. Fauna, No. 8, 1895, p. 194, pl. xv, fig. 1.

Half-grown young are wholly plumbeous below, and darker and less washed with yellowish brown above than adults.

Measurements (average of 16 adults, 10 ♂♂, 6 ♀♀).—Total length, 214; tail vertebræ, 92 (collector's measurements from fresh specimens). Hind foot, 23; ear from crown, 12 (measurements from skins).

Skull.—The skull differs from that of *O. palustris* in no very important feature except in being much smaller. Total length (occipital plane to front border of nasals), 30; basal length (occipital condyles to front edge of intermaxillaries), 28; greatest zygomatic breadth, 16; greatest breadth of braincase, 13; least interorbital breadth, 6.

Type, No. $\frac{11297}{9557}$, ♂ ad., Boruca, Costa Rica, Dec. 10, 1891; George K. Cherrie.

Based on a series of 21 specimens (16 adult, 5 juv.), collected at Boruca, Costa Rica, Nov. 19–Dec. 10, 1891, by Mr. George K. Cherrie, for whom the species is named.

Oryzomys cherriei needs comparison with no other species known to me. In general appearance it most resembles *O. palustris*, but it is fully one-third smaller than any of the known forms of this species, from all of which it also differs decidedly in coloration. It has no close relation to any other described Central American species of the genus.

Peromyscus attwateri, sp. nov.

ATTWATER'S CLIFF MOUSE.

Above tawny brown, darker and much mixed with blackish along the median dorsal area, more golden on the sides, the lower edge of the dorsal area forming a strongly defined golden lateral line. Below pure white, the base of the fur plumbeous. Fore feet white to slightly above the wrists; hind feet white nearly to the tarsal joint, soles naked nearly to the heels. Ears very large, nearly naked, dusky, faintly edged with whitish. Tail sharply bicolor, dusky above, grayish below, moderately well haired (the annulations showing through more or less towards the base), and generally well tufted at the end.

Measurements.—Average of 10 adult specimens, measured in the flesh: Total length, 196 (187-216) mm.; tail vertebræ, 100 (96-110); hind foot, 21 (20-23); ear from notch (measured from the skins), 16 (15-17). The type, a breeding female, is rather above the average of the series, measuring as follows: Total length, 216; tail vertebræ, 110; hind foot, 23; ear, 17.

Skull (of type), total length, 28 ; basilar length, 26 ; greatest cranial breadth, 14 ; least interorbital breadth, 5 ; length of nasals, 9.5.

Type, No. $\frac{10401}{8712}$, ♀ ad., Turtle Creek, Kerr Co., Texas, March 12, 1895; H. P. Attwater.

This species is based on a series of 14 specimens collected on Turtle Creek, Kerr Co., Texas, May 24, 1894, and March 9–13, 1895, and on 3 from San Geronimo Creek, Medina Co., Texas, April 23, 1895. Several are in the nearly uniform dark gray pelage of the young, others are more advanced but still immature, while about one-half are 'young' adults, only a few being 'old' adults. One only (the type) has a very small spot of bright fulvous on the breast.

Peromyscus attwateri finds its nearest affines in *Peromyscus rowleyi* and *P. eremicus*, but seems to be clearly different from either.

This species is named for the collector, Mr. H. P. Attwater, who contributes the following interesting field notes.

"I call these mice 'Cliff Mice,' to distinguish them from the other form (*P. mearnsii*), because they are found in large numbers in the cracks and cavities of the rocky cliffs that border the rivers and smaller streams in the counties directly north and west of San Antonio. Though most numerous along the sides of cañons, they are also found in hollow trees, logs, fences, and cultivated fields, and about ranch buildings in the valleys, as well as in the cedar 'brakes' on the divides and high ground.

"The southern limit of the range of this species, in this part of Texas, is about ten or twelve miles north and west of San Antonio. I have not found it at San Antonio or south of it, and do not think it will be found east of Bexar or Comal Counties. The short tailed form (*P. mearnsii*) doubtless extends up the valleys into the range of the Cliff Mice, but the latter seem to restrict themselves to the rocky country.

"They feed on the different nuts and seeds which grow in endless variety all over this region, though their favorite food seems to be acorns and cedar berries. I believe they also prey extensively on birds' eggs."

Neotoma cinnamomea, sp. nov.

FULVOUS WOOD RAT.

Similar to *N. rupicola* Allen, but larger, coloration much deeper, and the ears darker.

Adult.—Above, in summer, buffy-ochraceous, with often a tinge of vinaceous; middle of dorsal region finely lined with black; sides clear strong ochraceous buff; feet and ventral surface pure white to the base of the hairs; tail bushy, dusky gray above, pure white below; ears brownish, thinly haired.

Young.—The young in first pelage are ashy above, with a tinge of fulvous, conspicuously varied with black, especially over the middle of the dorsal region; below white, with a tinge of ashy along the sides of the abdomen, owing to the slight plumbeous cast of the underfur. Tail terete, ashy white above, a little clearer white below.

From this stage they pass into the autumn coat, in which the upper parts are cream buff with an ashy shade, strongly lined with black; below white, with the basal portion of the fur on the sides of the abdomen ashy or pale plumbeous. Tail colored nearly as in the adult, but much less bushy.

Measurements.—Total length (average of 6 adult males), 364 (356-368); tail vertebræ, 158 (151-163); hind foot, 41 (40-43); ear from notch (measured from dry skins), 27 (25-28). Four adult breeding females, average slightly smaller, as follows: Total length, 343 (337-351); tail vertebræ, 148 (144-150); hind foot, 39 (37-41); ear from notch (from dry skins), 27 (26-28).

Type, No. $\frac{11092}{9387}$, ♂ ad., Kinney Ranch, Bitter Creek, Wyoming, July 9, 1895; Walter W. Granger.

This species is based primarily on a series of 31 specimens, collected by Mr. Granger at Kinney Ranch, Bitter Creek, Wyoming, July 6–Aug. 6; to which are also referred 2 specimens taken on the Uncompahgre Indian Reservation, Utah, April 2 and 9, and 3 taken on the Little Snake River, near the Colorado-Wyoming boundary line, Aug. 26. The adults of both sexes are well represented, as are the immature stages, from quarter-grown young to full-grown young of the year.

This species belongs to the same group of bushy-tailed Wood Rats as *N. orolestes* Merriam and *N. rupicola* Allen, being intermediate between them in size, but quite different from either in coloration. It is much smaller than *N. orolestes*, which it appears to most resemble in color. It differs from *N. rupicola* in its considerably larger size, and in its much deeper and more vinaceous buff shade of coloration, and much darker ears at all ages.

Microsciurus, subgen. nov.

Skull short, broad, the dorsal outline very convex, postorbital processes placed slightly behind the widest part of the malar, which is remarkably expanded. Premolars $\frac{2}{1}$.

In regard to external characters, the tail is narrow, and the ears are very small ; the pelage is short and close.

Type, *Sciurus* (*Microsciurus*) *alfari*, sp. nov.

This group of Squirrels, which will probably be found to include all of the Guerlinguets (as *Sciurus pusillus* Desm., and *S. chrysuros* Puch.), is exceptional for the peculiar form of the malar and the relatively great breadth and convexity of the skull.

Sciurus (Microsciurus) alfari, sp. nov.

ALFARO'S SQUIRREL.

Total length (measurements from dry skins), 290 ; head and body, 145 ; tail vertebræ, 105 ; tail to end of hairs, 145 ; hind foot, 35 ; ear from crown, 9.

Above, including upper surface of both fore and hind feet, dark olivaceous brown, minutely punctated with yellowish rusty, the hairs being blackish, slightly tipped with yellowish rusty, giving a dusky olivaceous general effect, becoming, however, more reddish brown on the head ; below and inside of limbs fulvous gray, varying in different specimens from buff to strong fulvous, and even rufous.

Upper surface of tail uniform in color with the back ; lower surface similar, hence much darker than ventral surface of the body, with which it is in strong contrast. The hairs of the lower surface of the tail are individually dark reddish brown or deep chestnut, with three narrow bands of black, the outer much broader than the others. Whole front of head washed with dark rufous, strongest on the sides of the head. Ears small, rounded, showing but little above the surrounding pelage.

In two old females the space enclosing each nipple is gray.

Skull.—Total length (front border of nasals to occipital crest), 36 ; basal length (front border of intermaxillaries to occipital condyles), 32 ; greatest zygomatic breadth, 22 ; least interorbital breadth, 13 ; nasals, 10.

Type, $\frac{11290}{9554}$, ♀ ad., Jiménez, Costa Rica, Jan. 24, 1894 ; George K. Cherrie. Based on three females, two of which are adult, and the other about two-thirds grown, collected by Messrs. Anastasio Alfaro and George K. Cherrie.

This species should be compared with *Sciurus pusillus* Desm. and *S. chrysuros* Puch., from either of which, judging from descriptions, it differs quite markedly in color, and from the former also in size.

Tamias pricei, sp. nov.

PRICE'S CHIPMUNK.

Intermediate in size and coloration between *T. merriami* and *T. hindsii*, but very different and about equally distinct from either.

Breeding Pelage (April specimens).—General color above, dull grayish brown, or gray varied with hazel and brown. Flanks tawny ; sides of shoulders and thighs strongly grayish ; lower surface whitish, the abdominal area washed more or less strongly with dull yellowish brown ; color of the flanks often encroaching considerably upon the sides of the ventral area. Dorsal stripes nine—five mixed hazel and black, and four clear ashy gray. The median dark stripe extends from the nape to the base of the tail ; the anterior third is mainly brown, mixed more or less in different specimens with black ; the posterior half or two-thirds mainly black, edged and more or less varied with hazel. The first lateral dark stripe on either side is similar to the median one, but is shorter, extending generally only from the shoulder to a little beyond the hip, and contains less black. The outer dusky stripe is still shorter and only slightly varied with black. Inner pair of light stripes gray ; outer pair broader and clearer gray. Post auricular patches small, dull grayish white ; light facial stripes clear gray ; the dark ones dull hazel brown, lighter than in *T. hindsii*, but much darker than in *T. merriami*. Tail above pale, the color beneath the surface being clay color, which shows conspicuously through the surface, the individual hairs being black at the extreme base, and then ringed broadly and about equally with clay color and black and tipped with whitish gray ; tail below centrally deep reddish chestnut, with a narrow border of black fringed with gray—about as in *T. hindsii*. Ears of medium size (much smaller than in *T. merriami*), externally blackish on the anterior portion and gray on the posterior third or half.

Measurements.—Average and extremes of 23 ♂♂ : Total length, 252[1] (234-278) ; tail vertebræ, 119 (109-130) ; hind foot, 35 (32-37). Averages and extremes of 17 ♀♀ : Total length, 256 (241-271) ; tail vertebræ, 122.5 (113-130) ; hind foot, 35 (32-37).

Type, No. $\frac{11288}{9552}$, ♂ ad., Portola, San Mateo Co., California, April 12, 1895 ; J. Diefenbach. Named for Mr. W. W. Price.

This very distinct form of *Tamias* is based on a series of 45 specimens taken at Portola, in the Santa Cruz Mountains, California, during the last week of March and the first two weeks of April, by Messrs. R. L. Wilbur and J. Diefenbach for Mr. W. W. Price, to whom I am indebted for the opportunity of examining a large collection of mammals from different localities in the Santa Cruz Mountains. *Tamias pricei* is almost exactly intermediate in all essential features between *T. hindsii* of the coast region of California north of San Francisco and *T. merriami* of the mountains of southern California (San Diego, and San Bernardino

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[1] From nose to end of caudal vertebræ; about 30 mm. should be added for the extension of the hairs beyond the vertebræ.

Counties, etc.). The gap between *T. pricei* and these forms is so evenly balanced that it is difficult to say to which of them *T. pricei* is most closely allied. The line of separation from either, so far as present material goes, is so sharp that it seems best for the present to treat the new form as specifically distinct from either, although it seems not improbable that specimens from intermediate points between the present known ranges of the three forms may show their complete intergradation. As at present known, *T. pricei* is much more distinct from either *T. merriami* or *T. hindsii* than *T. obscurus* is from *T. merriami*, or than *T. townsendii* is from *T. hindsii*.

Tamias wortmani, sp. nov.

WORTMAN'S CHIPMUNK.

Female, Breeding Pelage.—Above dull yellowish gray, with a slight vinaceous tinge. A narrow yellowish white band on either side from the ear to the hip, with no dusky band (or only a very slight trace of one) on the *innerside* of the white band ; a short broad black band on the outside of the white band ; sides of body below the black band yellowish white ; sides of neck and shoulders scarcely more yellowish than the sides of the body ; ventral surface whitish or grayish white, the dusky basal portion of the pelage more or less visible through the surface ; tail above grizzled dusky and pale yellowish, the hairs being black, tipped and sub-basally ringed with pale fulvous ; tail below, buff, with a broad subapical zone of black, and a narrow line of black near the base of the lateral hairs, visible only on parting the hairs ; feet buffy gray. In several specimens the lower, as well as the usual upper, black band on the sides of the body is wholly wanting.

The male is probably similar, but doubtless a little brighter colored, especially on the sides of the shoulders. (The males when taken had already assumed the post-breeding pelage.)

Male, Post-breeding Pelage.—Middle of the dorsal region, from the nape to the tail, yellowish gray, varied with black-tipped hairs, and with a faint wash of vinaceous, bounded on either side by a broad line of yellowish white, extending from the shoulders to the hips; top of head more strongly vinaceous or rufescent ; sides of neck and shoulders deep ochraceous, cutting off the lateral white line at the shoulders. Below the white lateral line is a short broad band of deep black ; sides of body behind the shoulders straw yellow ; below buffy white, with a tinge of dusky, due to the dusky basal portion of the pelage showing through the surface. Tail above dusky, edged and varied with fulvous ; below pale fulvous, with a submarginal narrow black band, and a narrow dusky line at the extreme base of the lateral hairs, only seen on carefully parting the hairs.

The female at this stage is probably similar but paler, especially on the sides of the shoulders. (None of the adult females when taken had acquired the post-breeding dress.)

Young in First Pelage.—Pelage soft and thin; above dull yellowish gray-brown, with a well-defined narrow white lateral line, and below this a short, broad dusky band; sides of body and below grayish white; tail above grizzled fulvous and dusky, below fulvous centrally, submarginally dusky, and edged with pale fulvous.

Young in Molt.—A large series of young of the year show that the young molt directly from the first pelage into a dress similar to the post-breeding pelage of the adults. This series also shows that the females are much less richly colored than the males, particularly over the sides of the neck and shoulders.

Measurements.—Seven adult females give the following averages and extremes: Total length, 280 (271–292); tail vertebræ, 95 (87–100); hind foot, 42 (41–44). Four adult males give the following: Total length, 272 (260–282); tail vertebræ, 96 (92–101); hind foot, 43 (42–44).

Type, No. $\frac{11057}{9352}$, ♂ ad. (still partly in molt), Kinney Ranch, Bitter Creek, Wyoming, July 13, 1895; Walter W. Granger.

Named for Dr. J. L. Wortman, the Director of the American Museum Palæontological Expeditions to the western Bad Lands, to whose interest in Mr. Granger's work is largely due his eminent success during the field seasons of 1894 and 1895.

This species is based on a series of 55 specimens collected by Mr. W. W. Granger, in the vicinity of Bitter Creek, Wyoming, July 5–Aug. 2, 1895. The series consists largely of young of the year, but includes about a dozen adults, representing both sexes. Both adult and young are in molt, but the greater part have nearly acquired the post breeding dress.

This species is perhaps most nearly related to *Tamias lateralis*, but combines in a singular manner the characters of the two 'couplets' into which Dr. Merriam, a few years since (N. Am. Fauna, No. 4, Oct., 1890, p. 18), separated the *T. lateralis* group. It differs from *T. lateralis* and *T. cinerascens* in having the whole under surface of the tail (except the submarginal black band common to all) uniform fulvous as in *T. castanurus* and *T. chrysodeirus*, but differs from the latter, and also from *T. lateralis* and *T. cinerascens* in the entire absence of the inner black lateral band. In the entire series of 55 specimens, made up of examples of all ages and conditions of pelage, only three or four show even a trace of this inner black dorsal band—a feature sometimes lacking, it is true, in *T. lateralis ;* but in *T. wortmani* its nearly uniform absence is combined with a fulvous lower tail surface.

Spermophilus tridecemlineatus olivaceus, subsp. nov.

BLACK HILLS SPERMOPHILE.

Similar in size and markings to *S. tridecemlineatus pallidus*, but much darker, as regards the ground color of the upper parts, with the light stripes and spots pale yellowish olivaceous.

Breeding Pelage (July *females*).—Above ground color dusky brown or blackish, with no trace of ferrugineous or chestnut ; flanks, stripes, and spots pale creamy buff with a slight olivaceous effect ; below rather strong cream buff.

Post-breeding Pelage (July *males*).—Pelage longer and softer, but coloration not appreciably different.

Young of the year are similar in coloration to the adults.

Measurements.—Averages and extremes of 7 breeding adults (2 ♂♂ and 5 ♀♀): Total length, 252 (245–265) ; tail vertebræ, 89 (76–94) ; hind foot, 34.5 (33–37).

Type, No. $\frac{9271}{7586}$, ♀ ad., Custer, Black Hills, South Dakota, July 25, 1894 ; W. W. Granger.

This strongly-marked subspecies is based on 7 adults and 12 young of the year, the latter one-half to two-thirds grown. It differs from *pallidus* in its much darker ground color and the olivaceous creamy white tint of the light stripes and spots.

Spermophilus tridecemlineatus parvus, subsp. nov.

SMALL STRIPED SPERMOPHILE.

Much smaller than either *S. tridecemlineatus* or *S. t. pallidus*, and very different in coloration from either.

Breeding Pelage (April specimens).—Coloration, especially the ground color of the dorsal surface, much paler than in either *S. tridecemlineatus* or *S. t. pallidus*. Ground color above deep russet, slightly varied with blackish ; the stripes and spots grayish white with a very faint tinge of cream color ; feet and ventral surface white, the dusky basal portion of the hairs showing faintly through the surface.

Measurements.—Average and extremes of 5 specimens : Total length, 204 (200–207) ; tail vertebræ, 80 (75–86) ; hind foot, 30.6 (30–31).

Type No. $\frac{10838}{9135}$, ♂ ad., Uncompahgre Indian Reservation, northeastern Utah, May 2, 1895 ; W. W. Granger.

This subspecies is based primarily on two specimens from the Uncompahgre Indian Reservation, in northeastern Utah, taken respectively April 4 and May 2, to which are also referred 8 specimens from the vicinity of Bitter Creek, in southwestern Wyoming, taken July 21–Aug. 5, all collected by Mr. W. W. Granger. The series is very uniform in coloration, the exception being one or two of the July specimens in which the light stripes and spots, and also the flanks, are slightly more tinged with a faint wash of creamy white.

The type of Mitchell's *Sciurus tridecemlineatus* came from "the sources of the Mississippi River," and hence from Central Minnesota. Professor Baird, writing in 1857 (Mam. N. Am., p. 317), observes that specimens "from Wisconsin are seen to differ quite materially from those [from] further west, in a considerably larger size and darker color," "the spots and lines," he adds, being "not so large in proportion as in the lighter prairie specimens." In 1874 I separated (Proc. Boston Soc. Nat. Hist., XVI, 1874, p. 291) the pale western form here referred to as *Spermophilus tridecemlineatus pallidus*, without, however, giving any diagnosis. This was supplied three years later in my monographic revision of the American Sciuridæ (Mon. N. Am. Roden., 1877, p. 873). As was customary at the time, no type was designated, but it was stated that "Among the smallest and palest examples are the specimens from Fort Union and the Yellowstone and Platte Rivers, an especially pale and small phase characterizing the Mauvaises Terres of the Upper Missouri."

In now separating additional forms of this group, I would restrict *pallidus* to the arid region of the Plains, from the Upper Missouri southward to eastern Colorado, western Kansas, etc., and designate as its type region the plains of the Lower Yellowstone River.

The four forms of *Spermophilus tridecemlineatus* here recognized may be diagnosed as follows, the characters being based in each case on *breeding specimens:*

Ground color of dorsal surface blackish chestnut—dark chestnut mixed with a profusion of black-tipped hairs, the black generally prevailing; light stripes and spots pale yellowish white, the light stripes less than half the width of the intervening dark spaces; lower parts buffy white, the hairs dusky basally.... .. ..*tridecemlineatus*.

Ground color above clear chestnut, scantily varied with black-tipped hairs, the prevailing tone being rather light chestnut; light stripes and spots creamy white, the light stripes being nearly as wide as the intervening dark spaces; lower parts pale yellowish white to the base of the hairs...... ...*pallidus*.

Ground color dusky yellowish gray, the dark tint being made up of an intimate mixture of yellowish gray and black-tipped hairs, generally wholly without chestnut or ferrugineous; light stripes and spots pale yellowish white with a tinge of olivaceous buff; below pale creamy white, the hairs not darker at the base ....*olivaceus*.

Ground color russet, sparingly varied with black-tipped hairs; stripes and spots grayish white with a faint creamy tinge; lower parts clear whitish gray.. ......*parvus*.

Measurements.

	Total length.	Tail vertebræ.	Hind foot.
S. tridecemlineatus[1].. ...	293 (283–314)	99 (90–112)	40 (38–42)
S. t. pallidus[2].	227 (203–260)	73 (61– 89)	32.5 (31–34)
S. t. olivaceus[3]	252 (245–277)	89 (76– 94)	34.5 (33–37)
S. t. parvus[4]	204 (200–207)	80 (75– 86)	30.6 (30–31)

Blarina (Soriciscus) nigrescens, sp. nov.

Blarina micrura ALLEN, Bull. Am. Mus. Nat. Hist., V, 1893, p. 338, not *Sorex micrurus* TOMES (=*Blarina micrura* ALSTON), from Dueñas, Guatemala.

Pelage coarse, rather long, and not lustrous. Above dusky plumbeous, in some lights black; lower surface not appreciably different. Feet and tail blackish, nearly naked, the annulations of the latter being distinctly visible.

Measurements.—Head and body, 65; tail vertebræ, 22; hind foot, 12.

Skull, total length, 20; mastoid breadth, 9.5; length of nasals, 7; length of upper tooth row, 9; distance between outer edges of last molars, 6.3.

Type (and only specimen), No. $\frac{9591}{7952}$, adult, San Isidro (San José), Costa Rica, Sept. 5, 1891; George K. Cherrie.

This species is of about the size and proportions of *Sorex* [*i. e.*, *Blarina*] *micrurus* Tomes (P. Z. S., 1861, p. 279), described from Dueñas, Guatemala, but it is obviously very different in coloration,

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[1] Fort Snelling, Minn., 11 ♂♂, 3 ♀♀—all adult breeding specimens, measured in the flesh by Dr. E. A. Mearns, U. S. A.

[2] From Allen, Mon. N. Am. Roden., p. 877—16 specimens, various localities, probably not all adult.

[3] Custer, Black Hills, S. D.; 2 ♂♂, 5 ♀♀—all adult breeding specimens.

[4] Bitter Creek, Wyo.; 5 specimens—all practically adult.

B. micrura being described as having the upper parts "darkish grey-brown, with a slight grisly appearance," and the "whole under surface" as "lightish grey-brown, tinged on the chin and along the middle of the abdomen with yellowish rufous," with the feet and tail "of a lightish grey colour."

Blarina (Soriciscus) orophila, sp. nov.

Pelage glossy, very short, soft and velvety. Above dark brown (shading slightly on seal brown), becoming lighter on the sides, and passing gradually into smoke gray on the ventral surface, where the hairs are conspicuously tipped with whitish. Feet grayish brown; tail dusky above, distinctly lighter below, well clothed, and with a minute pencil at the tip. Ears rudimentary and not easily detected.

Measurements.—Head and body, 55; tail vertebræ, 21; hind foot, 11; head, 20.

Skull (too imperfect for complete measurements).—Length of nasals, 5; length of upper tooth row, 8; distance between outer borders of last molars, 5.5.

Type, No. $\frac{9640}{9558}$, adult, Volcan de Irazú, Feb., 1894; George K. Cherrie.

Based on two specimens, preserved in alcohol, one of which is adult, the other immature, collected as above, and kindly presented by Mr. Cherrie to the Museum. The description is based on the specimens in a dry state, after removal from alcohol, to which they have since been returned for safer preservation.

In color this species somewhat resembles *Blarina cinerea* but it is very much darker, and has a much longer tail. It is nearly one-third smaller (in actual bulk) than either *B. micrura* or *B. nigrescens*, and very different in color from either, particularly the latter, to which it has, for this group of animals, comparatively no resemblance.

Blarina orophila differs very strikingly from *B. nigrescens* in the entire structure of the first upper molariform tooth, the first outer cusp of which rises to the same height as the others, instead of being rudimentary and uncolored, as in *B. nigrescens*. There are also differences in every detail of structure between the two teeth, and also in the structure of the third upper molariform tooth, in the two species.

Article XI. — NOTES ON SOME SPECIMENS OF MINERALS FROM WASHINGTON HEIGHTS, NEW YORK CITY.

By E. O. Hovey.

Recent excavation at 171st Street and Fort Washington Avenue, New York City, has brought to light mineral specimens of more than local interest on account of their rarity or size or both, and the purpose of this article is to put on record some facts concerning their dimensions and occurrence. The minerals occurred in three pockets close together, aggregating eighty feet (about 24 m.) in length in a vein of coarse pegmatite in mica schist. The strike of the schist is about N. 30° E. (magnetic), and its dip 85° eastward, and the vein is essentially parallel thereto, with a maximum width of about 3 feet (1 m.). The body of the vein is granular gray quartz, feldspar (orthoclase), and flaky muscovite, in which were imbedded the specimens noted in the following lines. To Mr. William Niven is due the credit for discovering and exploiting the deposit.

Xenotime.—During the excavation of the roadbed of the new speedway along the Harlem River Mr. Niven[1] found a great many small xenotimes imbedded in oligoclase, and a few large ones, one of them being the largest ever found on the island up to that time. At the locality at present under discussion the xenotimes were fewer in number but averaged larger in size, and one exceeded the largest found on the speedway. The last mentioned crystal is 8 + mm. square, and its approximate height is 6 mm. It is a simple symmetrical octahedron composed of the unit pyramid. The color is clear yellowish brown, and the crystal is imbedded in granular gray quartz. A second crystal is 5.5 mm. by 6 mm. in horizontal dimensions, and has a semi-altitude of 3 mm. It is composed of the unit pyramid predominating with the unit prism well developed, and a second pyramid τ (311) indicated. It is imbedded in feldspar and mica. The third xenotime to be noted is a very perfectly preserved one imbedded so as to show only one set of pyramidal faces. It is 7+mm. long and 5 mm. wide with an apparent semi-altitude of about 3 mm., and is surrounded by the three minerals of the vein. The planes of all these crystals are pitted as if by etching.

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[1] Vid. On a new locality for Xenotime, Monazite, etc., on Manhattan Island. Am. Jour. Sci. III, l, 75, 1895.

Monazite.—This mineral, of good quality, was found in numerous small crystals and parallel growths. The largest crystal is translucent, clove-brown in color, and very perfect in its development. It is imbedded in quartz and feldspar. The portion exposed measures 13.5 mm. long and 6.5 mm. wide; the whole length may be 18 mm. The crystal is strongly columnar in habit and is not flattened on the orthodiagonal axis, as is so commonly the case in monazite. The planes present are *a* (110), *n* (120) and *r* (111) predominating, *m* (110) narrow and *w* (101) narrow and interrupted. A detached group of smaller crystals showing in addition to the planes just mentioned, the two clinodomes, *e* (011) and *u* (021), is 10 mm. in total height and 6 mm. in diameter. All the planes are more or less pitted.

Tourmaline.—Black tourmaline was abundant in the vein, mostly in small, brilliant crystals, but there were some large ones, of which one is worthy of note. It is 243 mm. long and 96 mm. in greatest diameter, the least diameter being 80 mm. It is a very simple crystal showing one termination consisting of the rhombohedra, *r* $(10\bar{1}1)$ and *e* $(01\bar{1}2)$. The body of the crystal is quite round, but on one side it has a small parallel growth, without terminal planes, extending about two-thirds of its length. At 164.5 mm. from the terminated end a seam of granular gray quartz from 5 to 9 mm. thick divides the crystal into two portions, but otherwise it is very compact. The matrix is granular gray quartz.

Miscellaneous.—Other minerals occurring here, in association with those already mentioned, are zircon in small long prismatic crystals, dumortierite, torbernite (?), autunite (?), apatite, muscovite, and garnet (almandite). The apatite is green in color, abundant, and is sometimes seen in small perfect crystals penetrating the tourmaline. As further indications of the large scale upon which the minerals crystallized at this locality, it may be mentioned that there were found several very large aggregates of garnets in parallel position, and crystals of muscovite fifteen centimeters and more in longest diameter. The largest garnet is about half of a single crystal which would measure 23 centimeters in axial diameter if it were complete. It is a trapezohedron with the dodecahedral planes well developed. The dumortierite occurs not only in the feldspar, but also as long filiform inclusions in the muscovite, singly and radiating from centers.

Article XII. — PERISSODACTYLS OF THE LOWER MIOCENE WHITE RIVER BEDS.

By Henry Fairfield Osborn and J. L. Wortman.

With Plates VIII–XI and twelve Figures in the Text.

Introduction.

The progress of our knowledge of the White River fossil fauna has been extremely rapid since 1892, owing chiefly to the discovery of the 'Protoceras Beds,' the location of the 'Metamynodon level,' and the very exact stratigraphic and expert collecting methods employed by the American Museum and Princeton exploring parties.

The most welcome result of the field work is that we are now securing complete skeletons of animals which have been hitherto represented only by isolated skulls and limbs. We can now replace the useful but largely conjectural 'restorations' of the last decade by figures taken directly from the skeletons. The two types illustrated in this Bulletin are the massive *Titanotherium*, and the smaller but no less interesting *Metamynodon*, drawn from complete skeletons which have recently been mounted by Mr. Hermann for the new hall of Vertebrate Palæontology.

The second result, less striking perhaps, but of equal importance, is that we are obtaining very much more perfect and abundant examples of the rarer forms of White River Mammals.

The present paper is confined to the publication of new or little known characters of the Perissodactyla, and includes the following points of chief interest:

1. The entire skeleton of *Titanotherium robustum* is described. The vertebral formula is shown to differ from that of all other Perissodactyla, and to agree with that of the Artiodactyla. It is probable that certain wide differences in the development of the

horns, which have been assigned a generic value, are merely sexual characters.

2. The White River Horses exhibit a very marked evolution in size as we pass from the lower to the upper White River levels. There is apparently a direct specific succession connecting *Mesohippus bairdii* Leidy, through *M. intermedius* (*nobis*) of the 'Protoceras Beds,' with *Anchitherium præstans* Cope of the John Day Beds. A distinct, very much larger, and apparently new type of Horse is the *M. copei* of the Protoceras Beds.

We have thus in the horse line reached the point long ago predicted by Lamarck in promulgating the evolution theory, namely, that the lines drawn in the Linnæan system of nomenclature would be finally obliterated by discovery. In fact we are now beginning to retain the binomial system upon grounds of convenience and of scientific courtesy, rather than upon lines of definition.

3. The true Lophiodontidæ of Europe are found to be represented in this country by the *Heptodon-Helaletes-Colodon* line previously referred by Marsh and ourselves to the Helaletidæ. The alleged *Hyrachus douvillei* of Filhol is actually identical with *Colodon*, showing that a contemporary transformation of the *Lophiodons* occurred in Europe and in this country. The peculiar foot formerly referred by us to *Mesohippus longipes* now appears to belong to a member of this phylum.

4. The differences between the Tapir, Lophiodon and Hyrachyus molar types are clearly defined.

5. The skull of *Hyrachyus agrarius* from the Bridger Beds is described in this connection.

6. The mounted skeleton of *Metamynodon planifrons* is described.

GEOLOGICAL SUCCESSION.

The stratigraphical position of the species described in this Bulletin is shown in the following table:

JOHN DAY BEDS, OREGON.

WHITE RIVER BEDS, SOUTH DAKOTA.

Approximate estimate of the thickness of the Beds.	General Character of Rock.	
PROTOCERAS BEDS.		
100 feet.	Leptauchenia Layer: nodule-bearing, pink-colored clays.	Aceratherium tridactylum, A. platycephalum, Mesohippus intermedius, Mesohippus copei.
50–75 feet.	Coarse sandstones, not continuous.	
BARREN CLAYS. 100 feet.	Light-colored clays.	
OREODON BEDS.		
75 to 100 feet.	Nodulous clay stratum. Bones white. Sandstones and clays. Bones rusty colored.	Aceratherium occidentale, Metamynodon, sp. indet.
10 to 20 feet.	Oreodon Layer: nodule-bearing. Bones with scale of ferruginous oxide. 'Red layer.'	Aceratherium mite, Aceratherium occidentale, Mesohippus bairdii, Colodon occidentalis.
50 feet.	Metamynodon Layer: sandstones and clays. Bones rusty.	Metamynodon planifrons, Aceratherium mite, Mesohippus bairdii, Colodon dakotensis, C. procuspidatus.
	Reddish gritty clay. Bones white.	
	Mingled remains of Titanotherium, Aceratherium, Mesohippus.	Aceratherium trigonodum, Mesohippus bairdii.
TITANOTHERIUM BEDS. (Total thickness, 180 feet.)	Upper beds.	Titanotherium robustum.

Family TITANOTHERIIDÆ.

Genus **Titanotherium** *Leidy.*

Titanotherium robustum *Marsh.*

Plates VIII and IX.

The chief result of the Museum Expedition of 1892, under Dr. Wortman, assisted by Mr. O. A. Peterson, was the discovery of a large *Titanotherium* skeleton (No. 518) in the upper Titanotherium beds of South Dakota near the head of Corral Cañon. The skull was first found, in a somewhat shattered condition, and then the neck, entire trunk and fore limbs, perfect even to the sesamoids, were excavated as far back as the last lumbar vertebra and the border of one ilium. At this point, to their great disappointment, the party encountered a sudden change in the rock, and found that the sacrum, remainder of the pelvis and hind limbs had been carried away by an erosion which had probably occurred some time after the original deposition of the entire animal. A vigorous search in the summer of 1894 for hind limbs of the proper proportions resulted only in the finding of a left tibia (No. 1075) and fibula (No. 1071), and a left pes (No. 1073), left calcaneum and astragalus (No. 1076). Finally, by the kind coöperation of the Princeton parties under Mr. Hatcher and Mr. J. W. Gidley, the Museum secured a perfect pelvis (No. 1065) and two femora (Nos. 1442, 1443) belonging to three different individuals. The size of these parts was determined (1) by the fact that the pelvis corresponds very closely to that belonging to the main skeleton; (2) one of the femora had associated with it metacarpal bones, which also agree in size with those of the main skeleton. We thus have every reason to believe that the proportions between the fore and hind limbs are very nearly accurate.

The entire animal was then put together and mounted with the greatest skill by Mr. Adam Hermann, head preparator of the Department of Vertebrate Palæontology. The only parts which he found it necessary to restore were the teeth of the left side and certain smaller gaps in the skull; the sacrum and a few of the caudals; the cuboid, navicular and cuneiforms of the left pes; part of the right tibia (No. 493), calcaneum (1073), and the major part of the right pes. These missing parts were carefully modeled from the opposite side or from other individuals of different size. The only parts missing are the manubrium sterni and some of the posterior sternals.

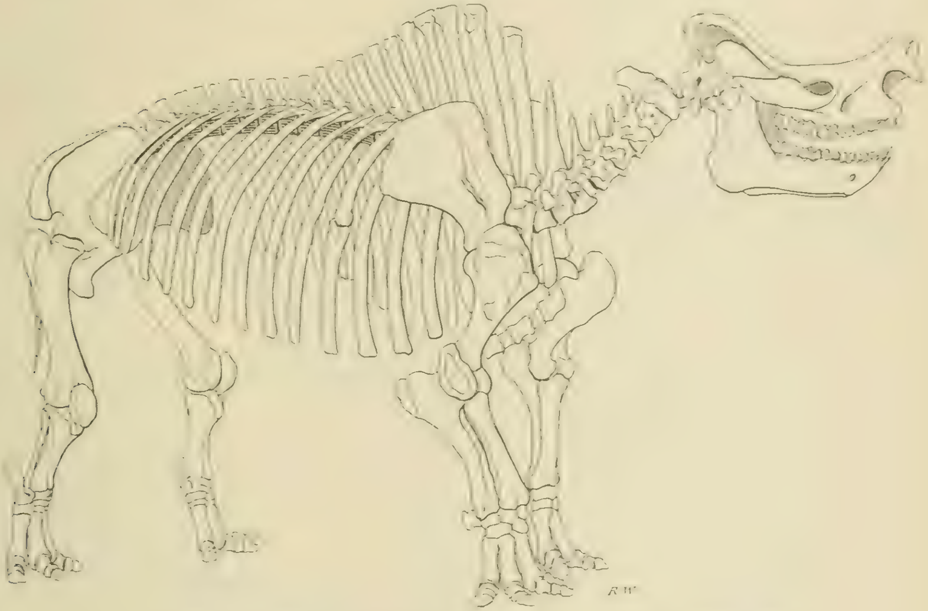

Fig. 1. *Titanotherium robustum.* Mounted skeleton (No. 518), ♂, seen from three-fourths front view. Approximately one-thirtieth natural size.

The completed skeleton is about 14 feet long, 8 feet high and 4 feet broad. The teeth are well worn, yet the epiphyses upon the summits of the dorsals indicate that the animal was not fully adult. An interesting feature of the skeleton is the exostosis and false joint in the center of the seventh rib, undoubtedly an after result of fracture.

The skeleton differs from the Scott-Osborn restoration of *Titanotherium proutii* (Fig. 2) mainly because *T. proutii* is a more primitive and less robust type. Marsh's restoration of *T.* (*Brontops*) *robustum*,[1] executed by Mr. Berger, is a remarkably skillful drawing of the trunk and limbs, but errs in the too small proportions of the skull, as seen by a comparison with our Fig. 1, a perspective drawing by Mr. Weber. The Scott-Osborn and Marsh restorations are both at fault, however, in placing too many vertebræ in the dorso-lumbar series. This animal actually possessed but *twenty* dorso-lumbars.

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[1] Am. Journ. Sci., Feb., 1889. p. 163.

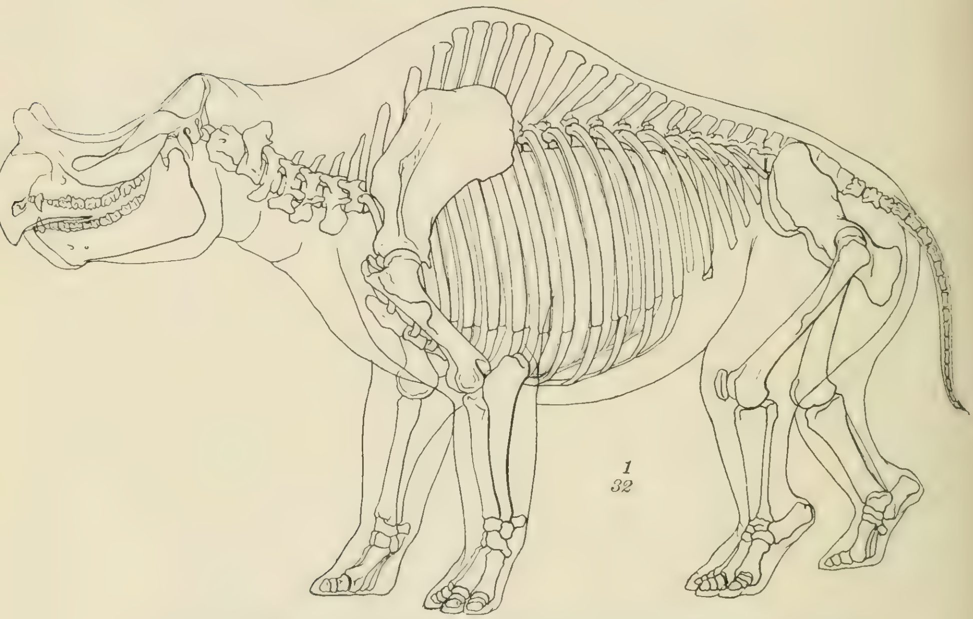

Fig. 2. *Titanotherium proutii.* As restored in 1887 by Scott and Osborn; now modified by reduction of the lumbars. One-thirty-second natural size.

SEXUAL AND SPECIFIC CHARACTERS.

This animal was found in the same level (Upper Titanotherium Beds), and agrees closely in size and appearance with the type skeleton of *Titanotherium* (*Brontops*) *robustum* of Marsh.[1] The cheek teeth characters (pm.=4, m=3) are also the same. In the American Museum specimen the premaxillaries are imperfect, and we cannot determine the number of incisors in either jaw. In Marsh's type there are two upper incisors. In the Museum collection there is also a fine skull (No. 492) with a very long pair of horns. This agrees closely with Marsh's type of *T.* (*Titanops*) *elatum.*[1] It is noteworthy that the alleged distinct species, *T. robustum* and *T. elatum*, and the American Museum specimens similar to them, both occur upon the same level, and were therefore contemporaneous. They agree in the length of the nasals, in many minor details of skull structure, and in the characters of the dentition. They differ mainly in the *size of the horns*, a character which is very generally of sexual significance only. The conclusion appears very probable that the genus and species *Titanops elatus* is founded upon a male individual of the genus and species *Brontops robustus*, the latter having been established upon a female individual.

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[1] Am. Journ. Sci., Oct., 1887, p. 4.

The species *T. robustum* appears to differ somewhat from the previously established *T. dolichoceras* Scott and Osborn,[2] in the flatter horn section and longer nasals, but it may subsequently appear that these differences are not of specific value.

Dimensions of Skeleton.

	Feet.	Inches.	Metres.
Length, tips of nasals to bend of tail	13	8	4.15
Height	7	7	2.30
Breadth, across pelvis	3	10	1.18
Hind limb, total length	5	6	1.67
Femur, “ “	2	7	.79
Tibia, “ “	1	4½	.42
Metatarsal III, length		8	.205
Fore limb, total length, including scapula	6	9	2.05
Scapula	2	2½	.67
Humerus	1	9½	.55
Radius	1	6	.46
Ulna, including olecranon	1	11½	.60
Metacarpal III, length		9	.23
Skull, length, incisors to condyles	2	7½	.80
Molars, Premolars, Canine inclusive	1	5	.45
Vertebral column, total length, excluding caudals, (including intervertebral spaces)	9	3½	
7 Cervicals, total, inferior centra	2	4	.71
17 Dorsals, “ “ “	5	5	1.65
3 Lumbars, “ “ “		11	.28
4 Sacrals, “ (estimated)		7½	.19
20 Caudals, “ “	3	9½	1.15
4th Dorsal Vertebra, length, with spine	2	3½	.70
5th Rib, length, outer measure	3	2	.96
8th “ “ “ “	3	7½	1.11

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[1] Op. cit., p. o.

[2] Bull. Mus. Comp. Zoöl., Vol. XIII, 1887, p. 160.

The most characteristic features of the animal are the following :

Skull. — The nasals are of medium length ; the horns are short, forwardly projecting, and imperfectly ossified at the tips. The zygomatic portion of the squamosal shows a decided posterior bulge but no shelf-like projection. The supra-occipital border is deeply indented.

Vertebræ.—The fine series of vertebræ belonging to No. 518, complete to the last lumbar but lacking the sacrals and caudals, enables us to fully describe and illustrate the backbone. The plate (Pl. IX) is taken from an enlarged drawing made just after the vertebræ were mounted. The exceptional number of dorso-lumbar vertebræ suggests the note that a fracture was found through the center of the first lumbar, but there is no probability that one of the lumbars is missing. The formula is :

Cervicals, 7 ; dorsals, 17 ; lumbars, 3 ; sacrals, 4.

The number of dorso-lumbars therefore coincides with that in the Artiodactyla, namely, D.L. = 20, and is from three to four less than that typical of the Perissodactyla, namely, D.L. = 23–4. This corroborates a view already advanced by Osborn,[1] that of all Perissodactyla the Titanotheres present the greatest number of affinities to the Artiodactyla ; these affinities may now be summarized as follows : the artiodactyl type of fore foot, the artiodactyl type of superior molars, the vertebral formula characteristic of the Artiodactyla. It is premature to infer more from these facts than that if the Artiodactyla and Perissodactyla were derived from a common stem form, as expressed in the larger division Diplarthra of Cope, the Titanotheres have diverged less from this stem than other Perissodactyls, at least in the development of the above-mentioned characters. It is possible also that the shortening of the backbone may be *secondary*, so that the above generalization requires further verification by the discovery of the vertebral formula in the ancestral Titanotheres.

In details the vertebræ show many resemblances to those of *Palæosyops paludosus*, as described by Earle. The atlas has a broad powerful transverse process with an inferior flange pierced by the vertebrarterial canal ; the suboccipital nerve issued just above the anterior border of the process. The axis has a peg-like odontoid and a powerful spine. The cervicals 3–6 are characterized by a progressive increase in the height of the neural spine, in the size of the transverse process and extension and depression of its inferior lamella; the post-zygapophyses are flat, similar in shape, and face downwards and outwards. The 7th cervical is imperforate with a greatly reduced transverse process. The dorsals are characterized by the sudden elevation, in d. 1–4, and gradual sinking of the spines as we pass backwards. Every dorsal from d. 1–17 is characterized by a facet for both the head and tubercle of the corresponding rib. The zygapophysial facets lie in a nearly horizontal plane from d. 1 to d. 11; they then gradually shift to an oblique plane from d. 12 to d. 14; and into a nearly vertical plane in d. 15–16. The zygapophyses of the 17th dorsal and 1st lumbar vertebræ are distinguished from all the others by being slightly concavo-convex. The post-zygapophysis of the 2d lumbar is plane and slightly oblique in position. The lumbar metapophy-

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[1] 'Rise of the Mammalia in North America,' p. 34.

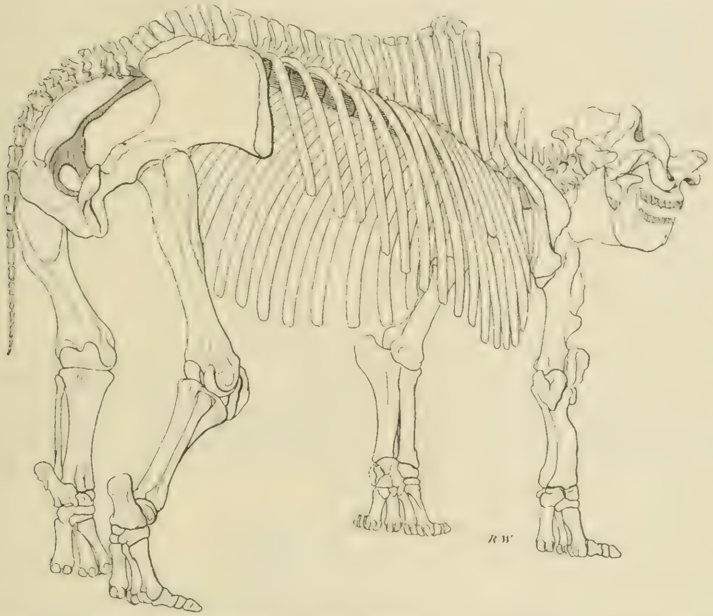

Fig. 3. *Titanotherium robustum.* Mounted skeleton seen from behind. Approximately one-thirtieth natural size.

ses are flat and horizontal. The 3d lumbar articulates by an oblique facet and broad metapophysial process with the 1st sacral. The sacrum is unfortunately missing. Marsh states that there are four in this species.[1] We find four in the perfectly preserved pelvis (No. 492) associated with the supposed male skull. The caudals are from a number of different individuals. The neural spines apparently extend back to the 8th vertebræ. The transverse processes die out upon the 6th. A well-developed chevron appears upon the 2d, and perhaps in a perfect series would be found upon the 3d.

Fore Limb.—The fore limb is of an extremely robust character. The scapula shows a projection of the anterior border, a rounded and rugose superior border, and a long incurved posterior border. The most striking bone is the humerus with its huge plate-like great tuberosity, strong deltoid ridge, and powerful ectocondylar ridge. The shaft of the ulna is trihedral in section and stands well out from that of the radius. The radius has a flattened shaft and a well-marked inferior extensor groove. The structure of the manus is typically *paraxonic* or artiodactyl, the median axis of the foot lying between the third and fourth digits. Other features of the skeleton are well illustrated in the drawings.

Family EQUIDÆ.

Subfamily ANCHITHERIINÆ.

Genus **Mesohippus** *Marsh.*

Representatives of this genus are exceedingly abundant in the White River formation, and as a result of the several expeditions made by the Museum party into these beds an unusually fine series of Horses of this epoch is contained in the collection.

Several definitions of the genus have been given, the latest of which is by Scott,[2] in which he assigns the presence or absence of the enamel pit in the superior incisors to distinguish it from the John Day Horses, which he places under the generic title of *Miohippus.* He ascribes to *Mesohippus* complete absence of any enamel invagination in the upper incisors, but adds in a footnote,

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[1] Am. Journ. Sci., Feb., 1889, p. 164.
[2] Trans. Amer. Philos. Soc., 1893, p. 79.

"The upper incisors of this genus are not known, and future discovery may show that it is not generically different from *Miohippus*, but the generally less advanced character of the dentition renders it probable that the character of the incisors is as assumed above."

There are in our collections two specimens in which the superior incisors are preserved in an almost perfect condition; they both show a very decided pitting of the enamel in the two outer teeth. It will therefore be readily seen that the generic distinction between the White River and John Day species fails, and we really know of no characters of generic value by which they can be distinguished. In a like manner the distinctions between *Mesohippus* and *Anchitherium* disappear when one examines carefully a large series of White River and John Day Horses.

Previous to the discovery of the Protoceras fauna in the upper part of the White River beds, but a single species, *M. bairdii*, had been generally recognized[1] in this formation, but with the acquisition of a large amount of material from the upper level it is now possible to demonstrate that there were two and probably three species living in that region when the successive sediments were laid down.

SYNOPSIS OF SPECIES OF MESOHIPPUS.

M. bairdii.	*M. intermedius.*	*M. copei.*
1. Median pair of incisors not cupped.	1. Median pair of incisors slightly cupped.	1. Unknown.
2. Length of median metapodial of fore-foot, .080–.095.	2. Length of median metapodial of fore-foot, .130–.132.	2. Unknown.
3. Length of median metapodial of hind-foot, .107–.124.	3. Length of median metapodial of hind-foot, .151–.152.	3. Length of median metapodial of hind-foot, .189.
4. Parastyle of Sup. Pm. 2, small.	4. Parastyle of Sup. Pm. 2, enlarged.	4.[2] Parastyle of Sup. Pm. 2, slightly enlarged.
5. Intermediate cusps of Sup. Ms. and Pms. little separated from internal cusps.	5. Intermediate cusps same as in *M. bairdii.*	5.[2] Intermediate cusps of Sup. Ms. and Pms. well separated from internal cusps.
	6. Length of tibia, .240.	6. Length of tibia, .317.

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[1] Several species have been proposed for remains from this horizon, but it seems probable from the descriptions that they pertain only to individual varieties of the most prevalent species *M. bairdii.* Marsh has described *M. celer*, and Cope has described *M. cuneatum* and *M. exoletum* from the Miocene of Colorado.

[2] These characters are taken from the second specimen, No. 683.

Mesohippus intermedius, sp. nov.

This species is based upon an almost complete skeleton (No. 1196) from the sandstones of the Protoceras layer of White River. There are, moreover, numerous other specimens including perfect feet, skulls, jaws and other parts of the skeleton from the same layer of both the White and Cheyenne River localities contained in the collection.

These specimens all agree very closely in size, and average nearly one-third larger than *M. bairdii* from the lower or Oreodon layer. A comparison of the length of the median metapodials in different individuals is as follows :

	M. bairdii.	*M. intermedius.*
	M.	M.
Length of median metapodial, hind foot.........	.107	.151
	.114	.151
	.117	.151
	.124	.152
	M.	M.
Length of median metapodial, fore foot	.080	.130
	.095	.132

It will be seen from this table that there is marked increase in the size and length of the metapodials of *M. bairdii*, and it is interesting to note that the smallest examples of the species in our collection at least come from the lower layers, while the largest examples were found in the highest levels of the Oreodon stratum.

Not only do our specimens of *M. bairdii* show great variation in size, but marked *individual variability* in important structural characters as well. Fully fifty per cent. of the specimens show coössification of the three cuneiforms into a single bone ; others have the middle and internal cuneiforms united, while others again have all three bones free. The degree of reduction of the lateral metapodials is subject to much variation, as is also the extent of the development of the metapodial keels. The teeth vary greatly in the details of their structure, some showing much greater advancement than others.

In *M. intermedius* the variation is apparently not so great, especially as regards size. In some specimens the metapodials are thicker and stouter, the lateral ones being subcircular in section near the middle, while in other specimens the metapodials are decidedly more slender, the lateral ones being highly compressed laterally and very elliptical in cross section. In contrast with *M. bairdii* the arrangement of the cuneiform bones seems to be very constant ; the middle and internal are always united, while the external is free.

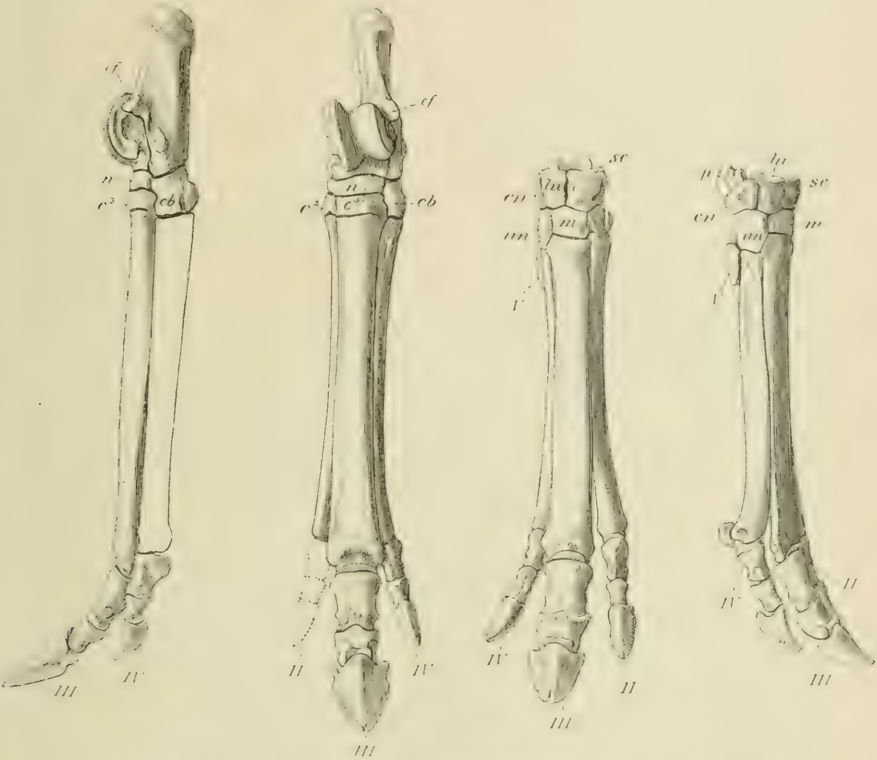


Fig. 4. Right hind foot and left fore foot of *Mesohippus intermedius*, front and side views. *P.* pisiform, *lu.* lunar, *sc.* scaphoid, *m.* magnum, *un.* unciform, *cu.* cuneiform, *cb.* cuboid, *n.* navicular, c^3. external, c^2. middle cuneiform, *cf.* facet for fibula. Slightly less than one-third natural size.

Another important distinction between *M. bairdii* and *M. intermedius* is seen in the degree of the cupping of the incisors. In *M. bairdii* the two outer incisors are very distinctly cupped, but the median pair show no traces whatever of the enamel pit. In *M. intermedius*, on the other hand, the median pair are slightly but distinctly cupped. In this respect the incisors of *M. intermedius* stand exactly half-way between those of *M. bairdii* and the John Day species, *Anchitherium præstans*, in which the median incisors are always distinctly and almost as strongly cupped as the two outer ones.

In the superior premolar dentition there are also important differences which point strongly in the direction of the John Day species, especially *Anchitherium præstans*. In *M. bairdii* the internal cingulum of the first superior premolar is but little developed, and does not form with the principal cusp a distinct basin; in *M. intermedius* the cingulum is more strongly developed and a distinct basin is formed.

In the second superior premolar of *M. bairdii* the parastyle or cingular cusp at the antero-external angle of the crown is small and scarcely larger than those on the succeeding teeth. In *M. intermedius* this cusp of the second premolar is considerably enlarged, giving to the crown an incipient triangular appearance. In *Anchitherium præstans* the enlargement of this cusp is carried still further, and in *Protohippus* and *Equus* the crown of the tooth is of a triangular shape in front.

The chief distinctions between *M. intermedius* and *Anchitherium præstans* are seen in the cupping of the median pair of incisors, the greater enlargement of the parastyle of the second superior premolar, the union of the posterior cross-crest with the outer wall in the superior molars and premolars, the greater reduction of the lateral metapodials, and the larger size of the latter species.

Mesohippus copei, sp. nov.

This species is founded upon the complete half of a pelvis, femur, tibia, and part of a hind foot (No. 1197), together with a complete median metapodial, and one lateral metapodial of the hind foot of another individual (No. 1198), a collateral type. These remains indicate an animal much larger than *M. intermedius*, and this is, so far as we know, the largest horse of the White River epoch, larger even than *A. præstans* of the John

Day. A comparison of the measurements of these bones with those of *M. intermedius* is as follows :

	M. copei.	*M. intermedius.*
	M.	M.
Length of tibia	.317	.240
Width of astragalus	.041	.035
Length "	.048	.041
Length of middle metapodial of hind foot	.189	.151
Length of pelvis	.334	
Width "	.231	

There are also in our collection two superior premolars (No. 683) of the right side, apparently the second and third of the series, that are much larger than any specimens of *M. intermedius.* We have therefore provisionally referred these teeth to this species. If this reference is correct, these teeth indicate a species quite different structurally from *M. intermedius.* Besides their greater size, the intermediate cusps are much more distinct, being separated from the internal cusps by a wide, deep notch, whereas in *M. intermedius* they form with the internal cusps a high crest and are very little separated.

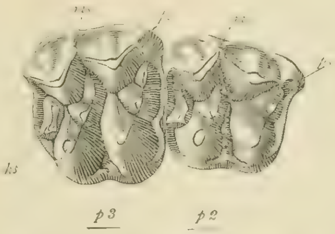


Fig. 5. Second and third right upper premolars of *Mesohippus copei.* Crown view. *Ms.* mesostyle, *hs.* hypostyle, *ps.* protostyle. Natural size.

The measurements of these premolars are as follows :

	M. copei.	*M. intermedius.*
	M.	M.
Length of second and third superior premolars	.037	.030
Width of second premolar	.018	.015
Width of third premolar	.021	.017

This species differs from *Anchitherium præstans* in the less reduced character of the lateral metapodials, and in the lack of completion of the cross-crests of the superior premolars, as well as the distinctness of the intermediate cusps. The two species are nearly equal in size.

All of our material is from the Protoceras layer of the Cheyenne River locality, but a large foot, probably of this species, was found by Mr. J. B. Hatcher, of the Princeton expedition, in the Oreodon Beds.

GEOLOGICAL SUCCESSION.

Equivalent Divisions in Europe.	LOWER MIOCENE	John Day.	John Day Beds.	*A. præstans.*	
	OLIGOCENE.	White River.	Protoceras Beds. 150 feet.	*M. intermedius.*	*M. copei.*
			Oreodon Beds. 140 feet.	*M. bairdii.*	? *M. copei.*
			Titanotherium Beds. 180 feet—total.	*M. bairdii.*	

The above table represents the nearly continuous sedimentation from the Titanotherium Beds into the John Day, having a total thickness of about eight hundred feet.

There can be little doubt that the three types, *Mesohippus bairdii*, *M. intermedius* and *A. præstans*, form a distinct and closely connected phylogenetic series of animals slowly specializing and constantly increasing in size. So far as we know *there is not a single character missing in the structural chain. Mesohippus* or *Anchitherium copei*, on the other hand, is somewhat larger than *A. præstans*, and forms a side branch, leading possibly into one of the numerous parallel species which Cope and Scott have described from the John Day and Deep River Beds.

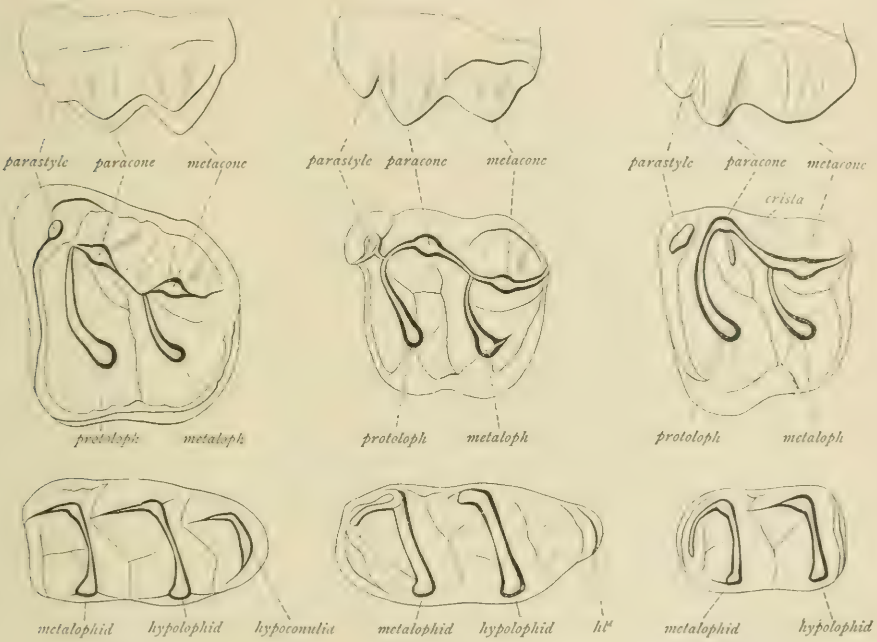
Family LOPHIODONTIDÆ.

(*Sensu strictu.*)

A family of lophodont Perissodactyls intermediate between the Tapiridæ and Hyracodontidæ. Superior molars, with paracone and metacone of same size but differing in shape. Metacone pushed inwards, more or less concave. Paracone lengthened. Metacone shortened.

Heptodon.	*Lophiodon.*	*Helaletes.*	*Colodon.*
Incisors $_{3}$, premolars $\frac{4}{4}$-$\frac{4}{3}$. Third and fourth superior premolars without posterior crests. Digits 4-3 Median toes enlarged.	Incisors $_{3}$, premolars $\frac{3}{3}$, without posterior crests. Manus and pes unknown.	Incisors $_{3}$, premolars $\frac{4}{3}$. Third and fourth superior premolars with posterior crests.	Incisors $_{2}$, premolars $\frac{4}{3}$. Second, third and fourth superior premolars with posterior crests.

It now proves that Leidy was very near the truth in referring to Cuvier's genus *Lophiodon* certain Bridger (*L. nanum*) and White River (*L. occidentalis*) jaws and teeth. The discovery of the superior molar series of *Colodon* demonstrates beyond a doubt that true Lophiodontidæ, not in the loose sense of the term of Cope, Lydekker and Flower,[1] but in the strict phylogenetic or true relationship sense, were represented in North America by the animals hitherto grouped in the family Helaletidæ by Marsh and Osborn. This family identity has been anticipated by Osborn.[2] The true American Lophiodonts are now seen to be


parastyle
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metalophid
hypolophid
hypoconulid
metalophid
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hl
metalophid
hypolophid

TAPIROID.
(*Systemodon.*)

LOPHIODONT.
(*Lophiodon.*)

HYRACODONT.
(*Hyrachyus.*)

Fig. 6. PRINCIPAL LOPHIODONT MOLAR TYPES.

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[1] 'Mammals, Living and Extinct,' 1891, p. 373. By these authors, *Hyracotherium*, *Systemodon*, *Hyrachyus*, in fact all lophiodont Perissodactyls in which the premolars are simpler than the molars, are termed 'Lophiodonts' without regard to the wide gaps which separate them from the true *Lophiodon*.

[2] 'Fossil Mammals of the Wahsatch and Wind River Beds,' Bull. Am. Mus., 1892, p. 92. Also 'Rise of Mammalia in North America,' 1893, p. 39.

Heptodon of our Wahsatch, *Helaletes* of the Bridger and Uinta, and *Colodon* of the White River. It now appears that besides *Lophiodon*, both *Helaletes* and *Colodon* probably occur in Europe as the last representatives of the Lophiodon line.

Cuvier's type, *L. tapiroides*, is a lower jaw found at Issel,[1] an horizon which contains *Pachynolophus*, and is approximately equivalent to our Bridger. The Bridger species of *Helaletes*, namely : *H.* (*Hyrachyus*) *nanus* Leidy, *H. boops* Marsh, *H.* (*Desmatotherium*) *guyotii* S. & O., *H.* (*Dilophodon*) *minusculus* S. & O., are well known to differ from the Issel Lophiodons (*L. tapiroides* Cuvier, *L. isselensis* Fischer) in the possession of rudimentary transverse crests upon *two* superior premolars. In the higher White River horizon the species of *Colodon*, namely, *C. occidentalis* Leidy, *C.* (*?*) *longipes* O. & W., *C. dakotensis* O. & W., *C. procuspidatus* O. & W., differ still further from *Lophiodon* in the possession of posterior crests upon *three* of the upper premolars.

The true molar pattern in *Heptodon*, *Lophiodon*, *Helaletes* and *Colodon* is identical; the question arises, can we separate the oldest American type, the Wind River or basal Bridger *Heptodon*, with its unmodified premolars, from *Lophiodon?* It now seems that we can do so. So far as we know, Cope's *Heptodon* is nearly identical with Cuvier's *Lophiodon*, the only distinction being one of size, and the number of upper premolars. The likeness is in the identical pattern of the molar teeth and the absence of posterior crests upon the premolars.

The skeleton of *Heptodon*, as previously shown by the writers,[2] is highly specialized, resembling that of the *Hyracodons* in many respects, but tending still more to monodactylism. The climax of this tendency is shown in a White River hind-limb, which we at first[3] referred to *Mesohippus*, but which now appears to belong to a form probably related to *Colodon*. The extremities of *Lophiodon* are not known, or have not been described. The nearest approach to the *Heptodon* type of skeleton in the French Eocene beds is that which has been referred to *Paloplotherium minus* by the French palæontologists. The *P. minus* tarsus and hind limb are almost identical in size and in numerous minor characteristics with the *Heptodon* limb. We do not know whether the association of the *P. minus* skeletal parts with the teeth of the *Paloplotherium* type is absolutely demonstrated ; if it is not, it seems quite probable that the so-called *P. minus* feet belong not to the Palæotheres (from which they differ so widely), but to some small Lophiodont such as *Heptodon.*

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[1] Ossem. Fossils, 2d edition, Vol. II, p. 176, pl. i.
[2] 'Fossil Mammals of the Wahsatch,' Bull. Am. Mus., Vol. IV, Sept., 1892, p. 131.
[3] Bull. Am. Mus., 1894, p. 214.

Genus **Heptodon** *Cope.*

For a full account of this Wind River type, see our paper upon the Wahsatch Fossil Mammals, and Prof. Cope's description in the 'Tertiary Vertebrata.'

Genus **Lophiodon** *Cuvier.*

Under this genus should be included only those forms with simple premolars which are *identical* in molar pattern with Cuvier's type, such as *L. tapiroides* Cuvier, *L. isselensis* Fisher, *L. parisiense* Gervais, *L. buchsovillanum* Blainville.

We may confidently *exclude* all those European forms which have the true Tapir, Rhinoceros, Hyracodon or Amynodon molar pattern, and which undoubtedly belong to animals ancestral to *Cadurcotherium*, to *Protapirus*, to *Aceratherium*, and possibly to the Hyracodonts. This will remove from *Lophiodon* a host of wrongly-referred species.

The question, What is Lophiodon?[1] seems now nearer solution. It is intermediate in molar pattern and in skeletal characters between the Tapirs and Hyracodons or Rhinoceroses, and shows a mingling of their characters, but represents a line of descent entirely distinct from both.

Genus **Helaletes** *Marsh.*

For the synonomy and characteristics of this type, see Scott and Osborn's Memoir upon 'Mammalia of the Uinta Formation,' our paper upon the Wahsatch Mammals,[2] and Wortman and Earle's paper upon 'Ancestors of the Tapir from the Lower Miocene of Dakota.'[3]

[1] Osborn, American Naturalist, Sept., 1892, p. 763.
[2] Bull. Am. Mus. Nat. Hist., Vol. IV, Sept., 1892, p. 127.
[3] Bull. Am. Mus. Nat. Hist., Vol. V, August, 1893, pp. 159–180.

Genus **Colodon** Marsh.

There is no evidence that the true *Hyrachyus-Hyracodon* line existed in Europe ; the *Colodon* genus or stage of Lophiodont development, is probably represented in France by the animal from St. Gérard de Puy, which Fihol has mistakenly referred to *Hyrachyus*,[1] as *H. douvillei.*

In our former communication upon the American representatives of this genus,[2] we had no hesitancy in referring it to the family Helaletidæ from the North American Eocene, and regarding it as the probable successor of the Upper Eocene representative (*Helaletes*) of this family. Additional material, collected by the Museum Expedition of last year, now enables us to not only clear up the question of the species, but at the same time throws a new light upon the probable family relationship of these Tapiroids, as above detailed.

An analysis of the species may now be given as follows :

Size large ; length of last two lower Ms. and last two lower Pms., .072. Postero-internal cusp of the last lower premolar double. Internal cusps of superior premolars not fully distinct ; no external nor internal cingula on premolars	*C. dakotensis.*
Size large ; length of lower Pms. and Ms. unknown ; last inferior premolar unknown. Internal cusps of second and third upper premolars distinct and well separated ; an external and internal cingulum upon premolars	*C. procuspidatus.*
Size small ; length of last two Ms. and last two lower Pms., .055. Postero-internal cusp of last lower premolar single. Superior premolars unknown	*C. occidentalis.*
Previously established upon foot characteristics only, possibly equivalent to *C. dakotensis*	*C. longipes.*

Colodon dakotensis, sp. nov.

The type of this species consists of an entire superior molar and premolar dentition lacking only the first premolar of the left side (No. 1212). To this we add as a collateral type a specimen of another individual displaying the second and third lower premolars, the second and third lower molars of the right side, and the fourth upper premolar of the left side (No. 1213).

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[1] Annales des Sciences Geologiques, T. xvii, pl. vi, fig. 13.

[2] Wortman and Earle, 'Ancestors of the Tapir from the Lower Miocene of Dakota,' Bull. Am. Mus. Nat. Hist., Vol. V, 1893, Art. XI, pp. 159–180.

The superior cheek teeth consist of four premolars and three molars. The first premolar is small, having a triangular crown with a single fully-developed external and internal cusp. The postero-external cusp (tritocone) is faintly indicated by a groove in the main external cusp, as is also the antero-internal (deuterocone) represented by a small but distinct tubercle situated just in advance of the large internal cusp.

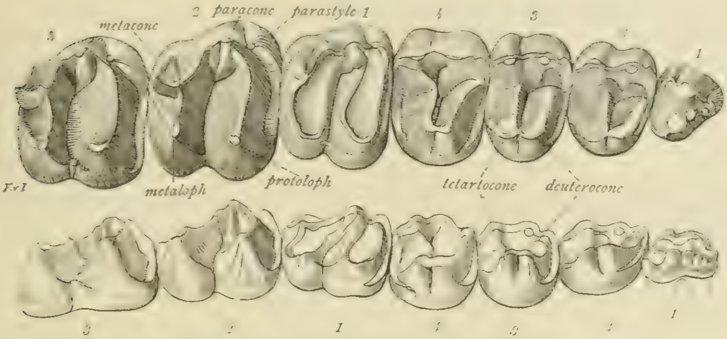

Fig. 7. Upper molar and premolar series of *Colodon dakotensis*, internal and crown views. Slightly larger than natural size.

The succeeding three premolars increase slightly in size from before backwards; their crowns are more or less quadrate in outline, and each displays a double external and internal cusp connected by well-defined cross-crests. The internal cusps of the premolars are not fully developed and distinct from each other in this species, but are indicated by a deep vertical groove upon the internal face of the crown. It is a matter of importance to note that in the assumption of the double internal cusps of the premolars, this species furnishes us with the incipient and transition stages, and further, that this complication began in the second premolar and proceeded backwards. This is demonstrated by the fact that the second premolar is more advanced in this respect than the third, and the third is more advanced than the fourth.

The arrangement of the external cusps is somewhat different from that of the true molars, in that the posterior external cusps of the premolars are not pressed inwards and concave as they are in the molars. The parastyle at the antero-external angle of the crown is faintly but clearly indicated, and there can be said to be no external or internal cingula developed upon any of the premolars.

The structure of the true molars has already been described,[1] and, so far as can be determined from the materials at hand, varies but very little in the different species. It is, however, worthy of remark that the cingulum in this species is but faintly if at all indicated upon any of the molars.

Of the inferior molar dentition the structure is very similar to that of *C. occidentale* in general appearance. An important structural difference between the species, however, is to be seen in the last inferior premolar ; in *C. dakotensis* the posterior portion of the crown widens rapidly, and the postero-internal cusp is double, whereas in *C. occidentale* this portion of the tooth is relatively much narrower and the cusp is single. Associated with difference of structure is a marked difference in size between the species ; *C. dakotensis* is larger and more robust in every way. This is made more apparent by a comparison of the following measurements :

	C. dakotensis.	*C. occidentalis.*
	M.	M.
Length of last two lower molars	.045	.034
Length of last lower molar	.025	.019
Length of last two lower premolars	.027	.021
Width of crown of last lower premolar	.010	.013
Total length of upper molar series	.091	—
Length of premolars above	.041	—

This species is from the Metamynodon layer, and was found by Mr. O. A. Peterson, a member of the party.

Colodon procuspidatus, sp. nov.

This species is proposed upon a complete superior maxillary dentition of the right side, in which the last molar is wanting (No. 1215). So far as the measurements are concerned, it agrees very closely in size with *C. dakotensis*. The most important difference between this species and *C. dakotensis* is seen in the degree of separation of the internal cusps of the premolars from each other, and the more decided approach towards the structure of the molars. In the second premolar the two internal cusps are almost as distinct as they are in the molars ; in the third premolar they are less so, while in the fourth they are separated by scarcely more than a vertical groove on the internal face of the crown. The cross-crests are more prominent than in the premolars of *C. dakotensis*, but the two external cusps are apparently not so distinct from each other as in that species. The external and internal cingula are prominent and distinct. The only means at present known of distinguishing *C. procuspidatus* from *C. occidentale* is by the smaller size and generally less robust character of the latter.

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[1] Loc. cit., p. 175.

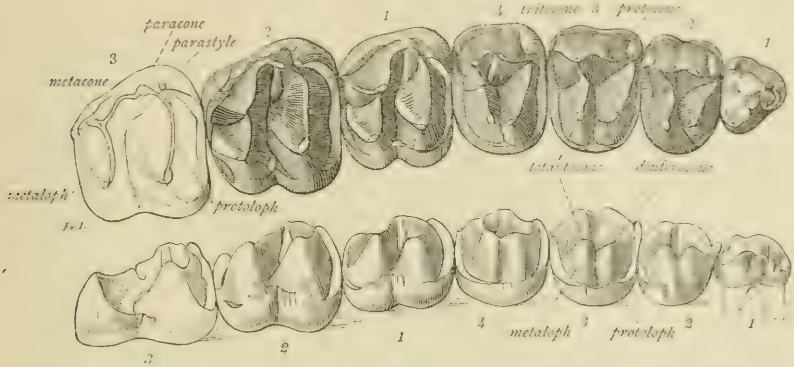

Fig. 8. Upper molar and premolar series of *Colodon procuspidatus*, internal and crown views. Slightly larger than natural size.

Found in the Metamynodon layer by Mr. J. W. Gidley.

Lower Milk Molars of C. OCCIDENTALIS.—The inferior milk molar dentition of this species is represented in our collections by two fragmentary lower jaws (Nos. 1044 and 1044*a*). With the exception of the first milk molar, which agrees very closely in size and structure with its corresponding premolar, the remaining two teeth of this series are of a more advanced pattern. They resemble the true molars in that the posterior cross-crest is complete and quite as well developed as the anterior. In the permanent premolars the posterior crest is never complete, the heel of the tooth preserving its primitive arrangement of a separate external and internal cusp.

The total length of this series slightly exceeds that of the corresponding premolars.

Colodon (?) longipes *O. & W.*

SYN. *Mesohippus longipes* O. & W.

It seems proper in this connection to again call attention to the specimen which we have described under this name.[1] It is probable that it is the foot of a species related to *Colodon*, although it differs in some important particulars from the fragmentary materials which we already know of *Colodon occidentale*. In some respects it resembles the Horses, but at the same time it presents such striking differences from any known members of this series as to absolutely prohibit its reference to any of the Equidæ. These differences may be summarized as follows: (1) The continuity of the ectal and sustentacular facets of the astragalus, as in the Rhinoceroses and Hyracodons generally; (2) the great vertical depth of the ectocuneiform; and (3) the articulation of metacarpal IV with the ectocuneiform, thus excluding the contact between the cuboid and metacarpal III, an extremely constant and highly diagnostic feature of all the Horses.

Its nearest prototype is apparently found in the foot of *Heptodon calciculus* of the Wahsatch. The two astragali are very similar in their details of structure, and the whole foot is strikingly similar in the two forms. Unfortunately the ectocuneiform is not preserved in our specimen of *H. calciculus*. A comparison of the foot of *C. longipes* with that of *Triplopus amarorum* Cope, reveals the closest similarity in all details of structure. There can be very little doubt therefore that *C. longipes* is the direct successor of some species of *Helaletes* or *Triplopus*; and whether the foot in question is to be associated with any of the known species of *Colodon* is still an open question. We have therefore retained the specific name, and have provisionally referred it to the genus *Colodon*.

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[1] Osborn and Wortman, Bull. Am. Mus., Vol. VI, 1894, Art. VII, p. 214.

Family HYRACODONTIDÆ.

We insert here a description of the skull of *Hyrachyus* from the Bridger Eocene, which is important in its bearing upon the relation of the primitive Hyracodonts to the true Aceratheres or Rhinoceroses.

Hyrachyus agrarius *Leidy.*

The skull of this important species has been known hitherto only from specimens showing the upper and lower teeth, the jaws and the posterior portion of the occiput in the Leidy (Philadelphia Academy) and Cope collections. The American Museum collection from the Bridger includes many parts of the skeleton and a nearly perfect skull and jaws (No. 1645), as represented in Figs. 9, 10 and 11. It was figured upon a very small scale on Plate II of our earlier paper.

Dentition.—All the teeth are preserved excepting the upper incisors. The formula is typical, $\frac{3}{3}, \frac{1}{1}, \frac{4}{4}, \frac{3}{3}$. The *incisors* are compactly placed, and decrease in size from the median to the outer pair. The median lower incisors ($\overline{\text{i 1}}$) are decidedly chisel-shaped or spatulate and nearly procumbent; the outer incisors ($\overline{\text{i 3}}$) are the smallest of the series, as well as the most erect and pointed. The upper canine is slightly larger than the lower; both canines are vertically placed, laterally compressed and somewhat incisiform, rather than of the typical canine form; in fact they resemble a much enlarged lateral incisor. This is an important character.

Upper Premolars.—The premolars in both jaws are simpler than the molars, or pm. $<$ m. The first is a small, laterally compressed tooth, with an internal cingulum. The second, third and fourth premolars ($\underline{\text{p. 2-4}}$) increase in complication, and present three successive stages of evolution toward the molar pattern; they are all triangular, and exhibit a backwardly hooked protoloph and thread-like posterior crest or rudimentary metaloph; there is also a trace of an incipient reduplication of the protocone in $\underline{\text{p. 4}}$, as shown in the accompanying sketches. This regular progressive evolution of the premolars from behind forwards is an important distinctive character, for it is *not* what we find either in the Aceratheres or in the true Lophiodontidæ, as here described. In the Aceratheres the anterior premolars acquire their transverse crests earlier than the posterior premolars.

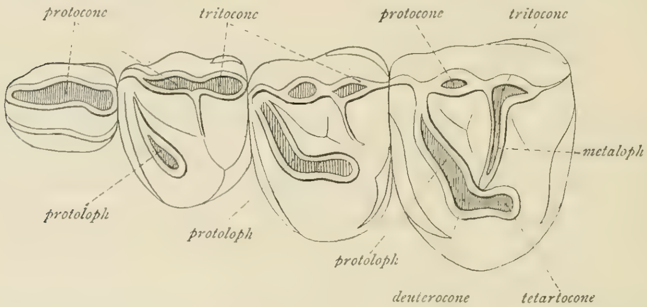
protocone
tritocone
protocone
tritocone
metaloph
protoloph
protoloph
protoloph
deuterocone
tetartocone

Fig. 9. *Hyrachyus agrarius.* Premolar series of left side. Diagram exhibiting the three regular stages of progression from $\underline{\text{p. } 2}$ to $\underline{\text{p. } 4}$, in contrast with that of the Lophiodonts.

Lower Premolars.—These teeth exhibit a similar progression, the last being decidedly the most complex; they show a high, obliquely placed metalophid and a low, basin-shaped talonid, which exhibits no trace of the hypolophid or posterior crest.

Molars.—The molars are incipiently but not fully rhinocerotine, because the elongation of the paracone, and consequent asymmetry of the external cusps, which is the distinctive feature of the rhinoceros molar, has not progressed very far. The second molar is the largest and most progressive tooth of the series; it displays a prominent parastyle, traces of a cingulum at the base of the metacone, a prominent anterior cingulum, a feeble posterior cingulum, and an incomplete internal cingulum. It exhibits a strong protoloph, a more slender metaloph and a delicate crista, but there is no trace of an anticrochet or of a

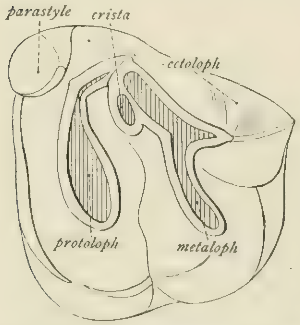
parastyle
crista
ectoloph
protoloph
metaloph

Fig. 10. *Hyrachus agrarius.* Diagram of second upper molar of the left side.

crochet. The convexity of the paracone is still marked upon the outer surface of the ectoloph.

Skull.—The skull is delicately proportioned, and the cranium is surmounted by a prominent but thin crest. The total length is 12 inches (30.5 cm.) ; the greatest breadth across the zygomatic arches is 5½ inches (14 cm.). It is thus narrower in proportion to its length than the skull of *Colonoceras agrestis*, as figured by Marsh.[1] The deep facial region is in contrast with the small and rather slender cranial region, as in the skull of the ruminant Artiodactyla. As seen from above, the face appears twice as long as the cranium, if we take the divergence of the sagittal crests as the dividing point. But, taking the *center of the orbits* as the middle point, we find that the face and cranium are exactly equal in length. The extent of the frontals, parietals, occipitals and squamosals is exhibited in Fig. 11.

In *superior* view, the skull exhibits long nasals tapering to slender points and diverging anteriorly ; a broad, slightly arched surface between the orbits ; a long, thin sagittal crest diverging into low sagittal ridges ; thin and delicate zygomatic arches ; a small, rounded brain-case, and a very narrow supra-occipital region. In *lateral* view (Fig. 11) we observe that the premaxillaries extend upon the sides of the nasals ; the extent of the lachrymals cannot be determined ; the skull also exhibits a deep, lateral notch upon the anterior border of the nasals, which is also very characteristic of the lower Miocene Rhinoceros (*Aceratherium*); an infraorbital foramen above the third premolar ; a large open orbit ; a wide space between the post-glenoid and post-tympanic processes ; the cranium pierced by numerous nutrient foramina ; the occiput slightly overhanging the condyles ; a long, delicate paroccipital process (partly broken off in this specimen) which is distinct or separated inferiorly from the postglenoid process. It is difficult to determine whether the mastoid portion of the periotic is exposed or not. The palate is somewhat injured, but the *inferior* view (Fig. 11) of the skull shows a considerable diastema between the canine and first premolar ; a prominence of the cranial axis at the junction of the basi-occipital and basi-sphenoid ; elongate or laterally compressed periotic masses opposite the

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[1] 'Dinocerata,' p. 64, Fig. 70.

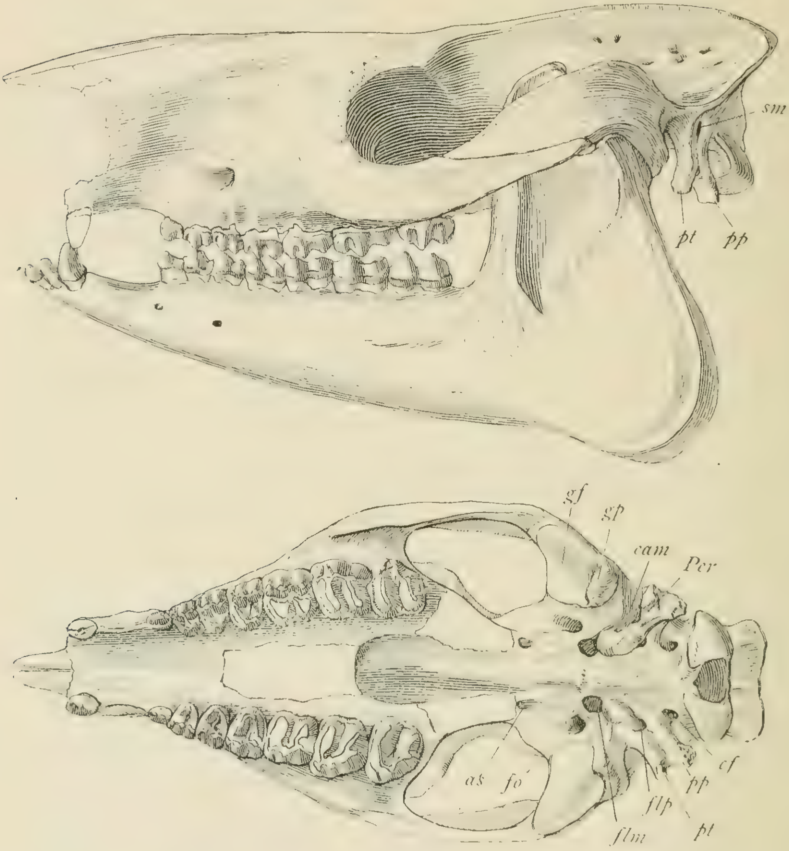

Fig. 11. *Hyrachyus agrarius.* Side view and base view of skull, No. 1645. Natural size.

entrance of the external auditory meatus. The *occiput* is laterally compressed; it narrows superiorly and slightly overhangs the condyles.

Foramina.—The alisphenoid canal pierces the sphenoid at the base of the pterygoids. The *foramen ovale* is peculiar in being very far back; it lies upon the outer side, slightly in front of the *for. lac. medium.* The *for. lac. posterius* is small. The postglenoid foramen, the mastoid foramen, and the condylar foramen are well marked.

Measurements.

	M.
Tip of nasals to summit of occipital crest	.305
Width of zygomata	.140
Height of occiput	.073
Length of molar-premolar series	.112
Length of lower jaw, angle to tips of incisors	.270

Lower Jaws.—The jaws are 10½ (27 cm.) inches in length. They exhibit a very slightly convex condyle; a narrow, strongly recurved coronoid process; a very deep, backwardly projecting angle with a sharply defined external and internal border. The rami taper anteriorly towards the shallow chin. The symphysis is 6.3 cm. in length and decidedly narrow.

This skull certainly bears a very close resemblance in many details to that of *A. mite*, and suggests at once that it stands in ancestral relationship to this true Acerathere, but the skeletal characters of the two animals have been shown to be widely different. The differences in dentition are also marked: (1) *Hyrachyus* shows no traces of the unequal development of the incisors and canines which we may confidently anticipate in the direct ancestors of the Aceratheres at this period. (2) The premolar evolution follows a different law from that seen in the Aceratheres. (3) The molars exhibit a precocious development of the 'crista' (Fig. 12), a feature acquired slowly in the Aceratheres.

The strong resemblance between the *Hyrachyus agrarius* and *Aceratherium mite* skulls therefore is chiefly important, because it demonstrates almost conclusively that the Hyracodons and Aceratheres were derived from a common stem form.

Family RHINOCEROTIDÆ.

Subfamily ACERATHERIINÆ.

Our list[1] of Aceratheres, published in July, 1894, requires revision. The specimens typical of *A. mite* Cope, from Colorado, exhibit a complete posterior crest in the fourth premolar, and are thus more progressive than the three skulls we referred to *A. mite*. In other respects the animals are closely similar. The *A. pumilum* Cope, from the Canada exposures, is as yet very imperfectly

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[1] Bull. Am. Mus., 1894, p 201.

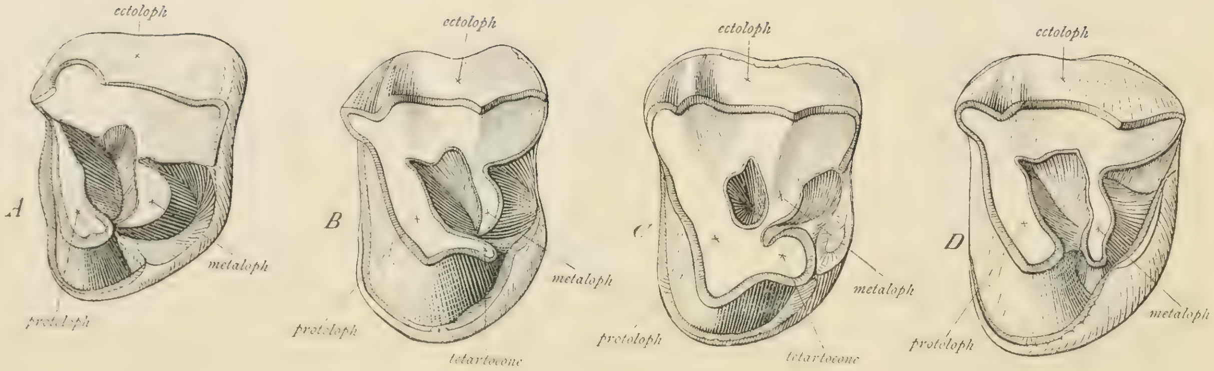
ectoloph
ectoloph
ectoloph
ectoloph
A
B
C
D
metaloph
metaloph
metaloph
metaloph
protoloph
protoloph
protoloph
protoloph
tetartocone
tetartocone

Fig. 12. *Aceratherium occidentale*. Fourth upper premolars, showing progressive modification in ascending strata. *A*, No. 1144, Lower Oreodon Beds. *B*, No. 1107, *C*, No. 1108, Middle Oreodon Beds. *D*, No. 1125, Upper Oreodon Beds.

characterized. The *Diceratherium proavitum*[1] of Hatcher proves to be identical with our *A. tridactylum.*

As regards geological distribution, it now appears certain that the predominant species of the Oreodon Beds was *A. occidentale* Leidy, although the *A. mite* occurs in the lower portion of these beds, and other species will undoubtedly be found in them. Leidy's type specimen, now in the National Museum, is characterized by a very simple condition of the fourth upper premolar, and was probably found upon the *Lower* Oreodon level; the grounds for this opinion are, (1) that No. 1107 in our collection, showing an identical stage of premolar development, was found in the lower Oreodon level; (2) that all the specimens from the *Middle* and *Upper* Oreodon Beds show a more progressive condition of the fourth premolar than Leidy's type; also a larger size of skull.

As regards specific succession, it is now certain that *A. occidentale* was directly ancestral to *A. tridactylum*, and it appears possible that *A. trigonodum* gave rise to *A. platycephalum;* in both, the horizontal or procumbent lower teeth is a marked characteristic. Much remains to be done upon the skeleton, and especially the feet, before the phyletic relationship of these species can be ascertained.

The large number of skulls in the collection belonging to *A. tridactylum* demonstrates that the species ran to two extremes, a high, long, narrow type, and a shorter, lower and broader type. The latter exhibit very prominent rugosities upon the nasals, which we might, with Hatcher, interpret as prophetic of *Diceratherium* were it not for the fact that equally rugose areas are found above the orbits and upon the zygomatic arches.

These two varieties of *A. tridactylum* are not due to age, but may be partly sexual. The molar structure shows no constant differences.

Family AMYNODONTIDÆ *S. & O.*

Genus **Metamynodon** *S. & O.*

Matamynodon planifrons *S. & O.*

PLATES X AND XI.

The Expedition of 1892 secured the skull and jaws of one animal (No. 555), and jaws of exactly the same size with the greater part of a skeleton of another animal (No. 546): namely, the vertebræ as far back as the 10th dorsal; many ribs of both sides, including an unbroken series, R. 1–14, on the right side; the left fore and right hind limbs complete. A vigorous search in 1894 supplemented these parts by a complete left hind foot (No. 1100), and an almost complete right fore foot (No. 1095). A complete left scapula (No. 1092) was also found with a pelvis belonging to an animal of slightly smaller size. These exceptional materials were supplemented by a few ribs, phalanges and caudals from other individuals. The spine of the axis is restored from another perfect specimen. The only parts of the skeleton which are entirely conjectural are the spines of the last cervical, and of four anterior dorsal vertebræ; also the entire lumbar series.

---

[1] American Geologist, May, 1894, p. 36[illegible].

The animal has been mounted with great care and skill by Mr. Adam Hermann, as represented in the camera perspective drawings (Plates X and XI).

The following are the chief dimensions:

DIMENSIONS OF SKELETON.

	Feet.	Inches.	Metres.
Length, tips of premaxillaries to bend of tail	9	7	2.93
Height	4	3½	1.30
Breadth, across pelvis (Skeleton No. 1092)	2	3¾	.70
Hind limb, total length	3	4½	1.03
Right innominate bone	1	9½	.55
Femur	1	8	.50
Tibia		10	.27
Metatarsal III, length		4½	.115
Fore limb, total length, excluding scapula	3	5½	1.05
Scapula	1	2	.35
Humerus	1	5½	.43
Radius	1	1	.33
Ulna, including olecranon	1	5½	.45
Metacarpal III, length	6	6¼	1.55
Skull length, premaxillaries to condyles	1	9¾	.55
Molar-premolar series		9	.23
Vertebral column, total length, including sacrals	6	10	2.09
7 Cervicals	1	9	.53
19 Dorsals	3	9½	1.16
4 Lumbars		10¼	.26
Sacrals (estimated)		5¼	.135
Caudals "	2	5½	.735
Ribs, 1st Rib	1	2	.355
5th Rib	2	6	.76
9th Rib	2	8	.81

The animal in life was over nine feet long, about three feet broad through the chest, and nearly five feet high, for it is probable that the anterior dorsal spines were longer than here represented. The general impression is of a very large skull with formidable canine tusks, small but prominent eye-sockets, and very broad, flat skull. The fore and hind limbs are quite powerful, but the metapodials are rather slender, especially in the manus. The most distinctive feature of course is the four completely functional digits, which widely separate this animal from the true Rhinoceroses. The chest has a well-rounded barrel, and the lower border of the abdomen must have been quite low. The anterior ribs are flat, but from the R. 7 backwards they become rounded and rather slender.

The skeleton has already been described in some detail.[1]

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[1] 'Fossil Mammals of the Lower Miocene White River Beds, Collection of 1892,' Bull. Am. Mus., Vol. VI, July, 1894, p. 209.

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